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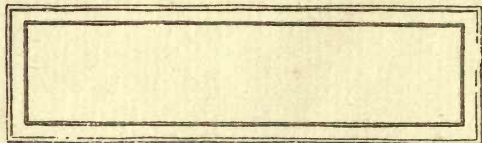
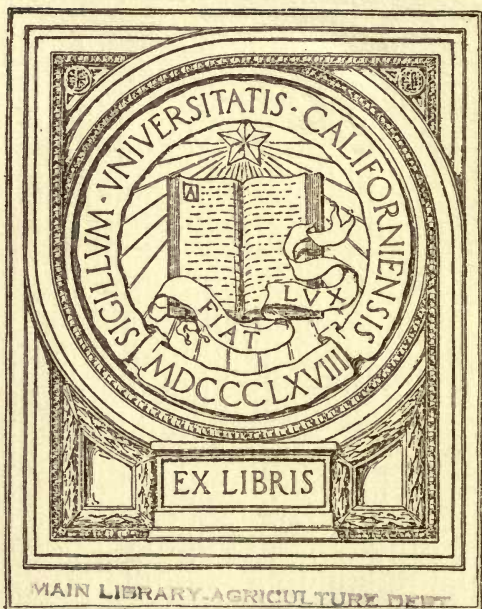


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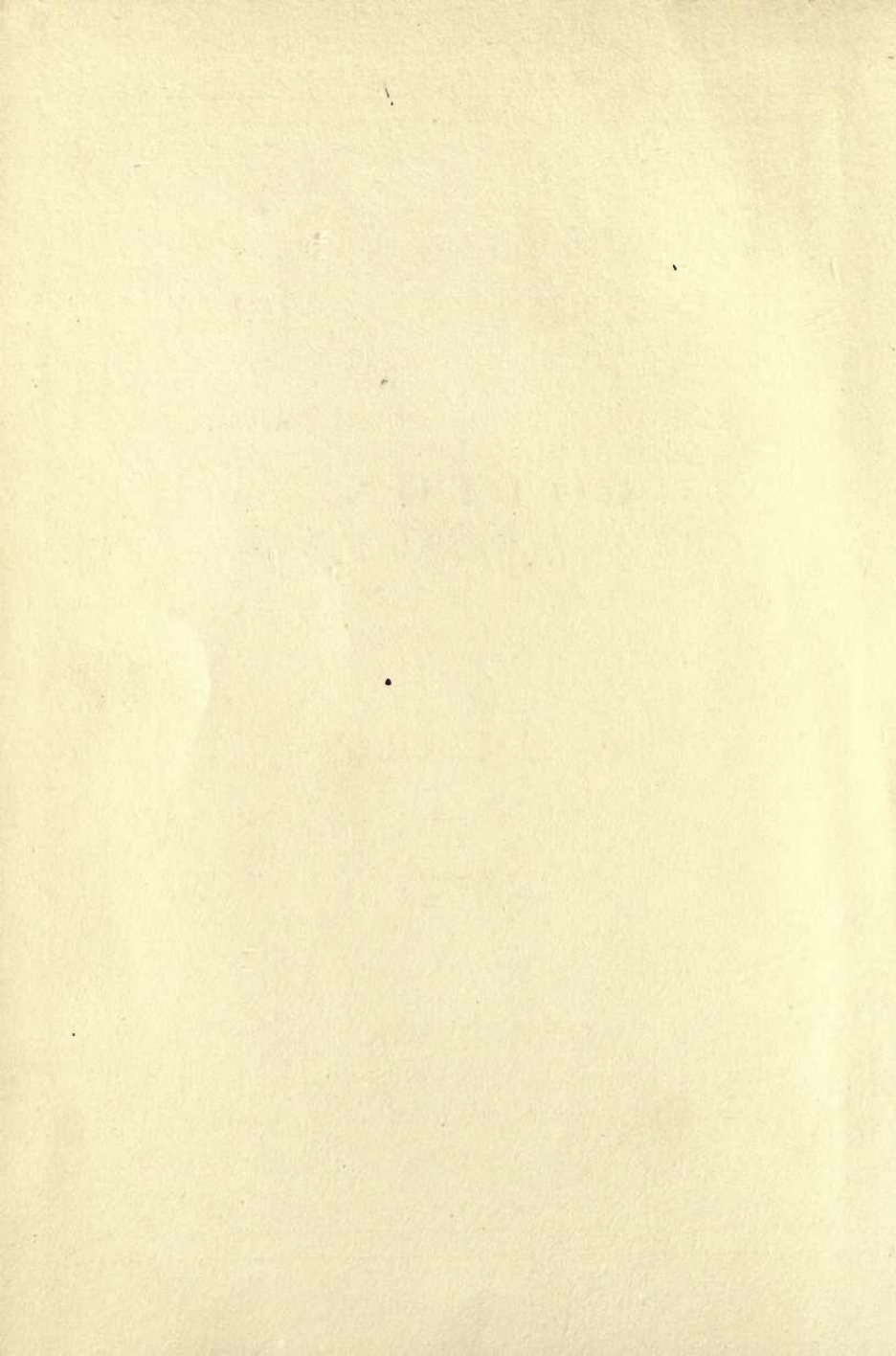
COTTON

THE UNIVERSAL FIBER

By W. D. DARBY



COTTON
THE UNIVERSAL FIBER



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THE UNIVERSAL FIBER

A SURVEY OF THE COTTON INDUSTRY
FROM THE RAW MATERIAL TO THE
FINISHED PRODUCT, INCLUDING DE-
SCRIPTIONS OF MANUFACTURING
AND MARKETING METHODS
AND A DICTIONARY OF
COTTON GOODS

By

W. D. DARBY



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TWELVE ILLUSTRATIONS

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An Introduction

THE DRY GOODS ECONOMIST presents this little book to the public and to the trade believing that it fills a long felt want. Letters have come to us for years asking for such a work, but not until recently have we had the information necessary to give a comprehensive yet condensed story of cotton—its history, its production and the final form in which it reaches the consumer.

Those whose interest is confined to the use of cotton will gain greater pleasure from their cotton clothing when possessed of the knowledge contained in the pages that follow.

The student of textiles will find the facts as presented a veritable mine of information. Few books of any size contain so much authoritative data as has been assembled herein.

The teacher of textiles will use this little book to make assignments for research into the various branches of the cotton industry because of the vast number of suggestions found in these pages.

The buyer of cotton in any of its stages will find his work more interesting and more profitable after a reading of "Cotton—The Universal Fiber."

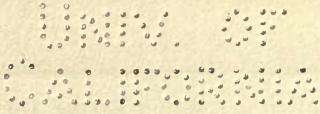
Briefly, this book has been written by Mr. Darby in a simple, plain, easily understood way, void of those technicalities which make so many books of this nature such dry reading.

We cannot recommend the book too highly to all those who would know more about the fiber that enters so largely into our lives from birth to death.

And the value of the book isn't limited to the pages that tell the story of cotton. The dictionary of cotton terms in the back is the best we have ever seen. As a matter of fact, it is more than a dictionary. It is in the nature of an encyclopedia, giving not only the definitions of the terms listed but some description of how the merchandise represented by the terms is made or manufactured, and often even telling the uses of the goods described.

Therefore, let us again emphasize that it is with pleasure the DRY GOODS ECONOMIST offers this work to you. May your pleasure and interest in reading the book be as great as was ours and Mr. Darby's during the many months spent in searching for, assembling and condensing the facts necessary to make up a really worthwhile book on "Cotton—The Universal Fiber."

ERNEST C. HASTINGS,
Managing Editor,
DRY GOODS ECONOMIST.



COTTON

THE UNIVERSAL FIBER

CHAPTER I

HISTORY AND DISTRIBUTION OF COTTON

COTTON has been frequently and aptly called the fabric of civilization. There is perhaps no other single commodity that has had such a determining effect on the world's history. It has played its part in the rise and fall of many nations. It has helped to bring civilization and prosperity to many peoples. It has been a pioneer in opening the channels of international trade and laying the foundations of modern industry. Its influence, reaching down from the dawn of history, has spread into every corner of the modern world.

The origin of cotton is lost in the dim mists of prehistoric legend. Probably it was first known and used in India. Certainly it is in Indian literature that the earliest mention of it is found. References to the manufacture of cotton into cloth are found in the historic "Rig Veda," written about 3400 years ago. In one of the sacred books of the Hindus, written about 2700 years ago, we find cotton mentioned frequently under the name of Kurpas or Kupas, a name by which it is still known in India. Just when and how the uses of cotton were first discovered it is impossible to say; but we know, at least, that it was being manufactured into cloth fully 1500 years before the opening of the Christian era.

For many centuries thereafter there is no record that would enable us to trace the progress of cotton. It is probable that cotton cloths from India gradually found their way into the marts of Persia, Arabia, Palestine and Egypt in very early times. The Bible makes reference to "white and violet colored cottons" in the description of the Palace of Shushan in the Book of Esther, and frequent references to cotton occur in the works of Strabo, Herodotus, Nearchus, Arrian and other Greek writers. Cotton goods imported from India

were used by the noble families of the Roman Empire, who also borrowed from the Orient the custom of using striped cotton awnings to protect themselves from the sun. By the opening of the Christian era the import trade in cotton goods from India to Asia Minor, Africa and Southern Europe had grown to large proportions.

Later the trade spread all over Europe and helped to build up the wealth and power of the great mercantile cities of the Middle Ages, such as Venice and Genoa. Although, during the early centuries of the Christian era, the manufacture of cotton goods had grown to be an important industry in the cities of Asia Minor, there is no record of cotton manufacture in Europe until the tenth century, when the Moorish chieftain, Abdurrahmah the Great, introduced both the growing of cotton and the manufacture of cotton cloth into southern Spain. The rest of Europe, however, continued to import its cottons from Asia until the fifteenth century, when the conquest of Constantinople by the Mohammedans cut off the trade routes between Europe and the East.

In search of a new road to India, Columbus sailed westward from Spain and Vasco da Gama sailed eastward from Portugal. Rounding the Cape of Good Hope, Vasco da Gama reached the Indian port of Calicut or Calcutta, from which we get the word calico. Thereafter cargoes from India, instead of coming through the Red Sea and enriching the ports of the Mediterranean, came around the Cape of Good Hope and enriched the ports of western Europe, particularly of England.

In England the importation of cotton goods from India grew to such large proportions that an Act of Parliament was passed forbidding the use of cotton either for clothing or for household purposes, because the popularity of cotton cloths threatened the ruin of the English wool industry. It is a peculiar historical coincidence that cotton goods should eventually become a leading item in England's export trade and that India should become the best customer for English cotton goods.

Meantime, Columbus, in his search for India, had discovered the New World. He noted that cotton grew in the West Indies and was made into cloth by the natives. Later Magellan, on his way around the world, found the natives of Brazil using cotton as stuffing for their beds. Cortez, on invading Montezuma's kingdom of Mexico, discovered that the natives made beautiful and richly colored cotton fabrics, some of which he thought worthy of sending home as presents to the Emperor of Spain. We have no means of knowing

at how early a period the manufacture of cotton goods was first started on the American continent, but archeological researches have disclosed that the Incas had been skilled in the weaving and dyeing of fine cotton fabrics probably for centuries before Pizarro set foot in Peru.

There is no evidence that cotton was cultivated or manufactured into cloth in what is now the United States before the coming of the English colonists. In a tract called "A Declaration of the State of Virginia," published in London in 1620, cotton wool is mentioned as one of the products of the Colony of Virginia; but this was probably wild cotton. According to "Purchas's Pilgrims," "cotton seeds were first planted as an experiment in 1621." At first the seeds were imported from the West Indies and the Levant. By the time of the Revolution cotton was being grown on a fairly large scale in the southern colonies, but chiefly for home consumption. A review of cotton cultivation in the United States, written in 1832, says that "previous to the year 1790 North America did not supply England with a single pound weight of cotton." It was not until after the Revolution and the invention of the cotton gin in 1793 that cotton growing and cotton manufacture began to develop in a really important way in the United States.

Now the United States leads the world in the production and consumption of cotton. In fact, the cotton industry of the world is largely dependent on the United States for its supplies of raw material. During the ten years preceding the war the total world production of cotton ranged from the low point of 17,216,000 bales in 1909-10 to the high point of 23,309,000 bales in 1913-14.

During the same period the production of American cotton ranged from the low point of 10,592,000 bales in 1909-10 to the high point of 16,108,000 in 1911-12. In other words, the United States produces normally a good deal more than half the world's total supply of cotton. Even these figures do not reveal fully the importance of the American crop, for much of the cotton grown elsewhere is of inferior grade and staple. A more accurate idea of the preponderant importance of American cotton in the world's total supply may be gleaned from the fact that about three-fourths of the cotton used by the British mills is imported from the United States.

Normally there are wide fluctuations from year to year in the size of the American cotton crop. A big crop one year is almost invariably followed by a small crop the next year. During the last

twenty years the crop has varied from a little over 10,000,000 bales to a little over 16,000,000 bales; so that we may take the average crop as being about 13,000,000 bales. Most of this supply is of good quality and averages about an inch in staple.

The classification of grades and staples will be explained in another chapter. Suffice it to say here that cotton running less than three-quarters of an inch in staple can be spun only into low-count yarns and is not adaptable for most of the cotton fabrics known in the dry goods trade. Cotton running more than an inch and a quarter in staple is used chiefly for the manufacture of fine sheer fabrics, fine knit goods, spool thread and automobile tires. Most of the cotton goods familiar to the trade are made from medium cotton, running from three-quarters of an inch to one and one-quarter inch in staple. And it is such cotton that forms the bulk of the American crop.

Outside the United States the chief cotton-growing countries are Egypt, India and China. The Egyptian crop is comparatively small, averaging only about 1,000,000 American bales; but most of it is long staple cotton of fine quality. At present projects are under way for the construction of dams on the White Nile and the Blue Nile, as well as for the reclamation of the water-logged areas in the northern part of the Nile Delta, and the completion of these projects will mean a considerable increase in the supply of Egyptian cotton.

The Indian crop averages somewhat over 4,000,000 American bales. This is merely an approximate estimate, as the available records are neither accurate nor comprehensive. Between one-third and one-half of this supply is good ordinary cotton running from three-quarters of an inch to one inch in staple. The remainder is short staple cotton. The records of the Chinese crop are even more haphazard, but as near as it can be estimated it averages about 1,500,000 bales, most of which is coarse, short staple cotton, running less than three-quarters of an inch. Some very good Chinese cotton, however, is grown in the Wei Basin in Shensi from seed introduced by American missionaries, and also in South Tungchow near Shanghai.

Russia, before the war, grew about 1,500,000 bales of cotton. At present the acreage planted to cotton in Russia is only a small fraction of what it was, but Russian production, no doubt, will revive in time. Cotton is also grown in Brazil, Peru, Argentina, Mexico, Colombia, Ecuador, Venezuela, the West Indies, Spain and

the South Pacific Islands. The total supply from all these sources amounts to no more than about 1,500,000 bales annually. Of this over 500,000 bales are grown in Brazil, about 250,000 in Mexico and about 150,000 bales in Peru. Most of the Brazilian and Mexican production is of medium staple or lower. The Peruvian production consists partly of rough tree cotton and partly of a fine variety of long staple Egyptian cotton. But the total amount of cotton grown in those countries is not enough to count seriously in the world's commerce.

Altogether it is clear that the mills of the world are to a large extent dependent on the American supply. A realization of this dependence has prompted other countries to undertake the production of cotton on a large scale in territory controlled by them. The most notable of these attempts is the work being done by the British Empire Cotton Growing Association for the promotion of cotton culture in Nigeria, Uganda, Nyasaland, Rhodesia and other parts of the British Empire. So far the supply from these sources has been inconsiderable, amounting to only about 30,000 bales. It may be expected to grow steadily. But for some years to come the mills of Great Britain and other European countries will have to look to the United States for the bulk of their supply of raw cotton.

CHAPTER II

THE COTTON CROP

IN ancient times cotton was looked upon as a sort of wool. Even as late as the Middle Ages it was popularly believed in Europe that cotton was the wool of lambs that grew on trees. This conception of cotton as a form of wool survives in the German name for cotton, which is *Baumwolle*, or tree wool. The Arabs, who were the great cotton goods traders of ancient times, and who introduced the cultivation of cotton and the manufacture of cotton cloths into the Levant and Europe, called it *qutun*, from which we derive the word cotton.

Of all short vegetable fibers, cotton is the only one which can be spun profitably into yarn. It owes this advantage to a characteristic twist in the fiber. Viewed microscopically, the cotton fiber looks like a thin, flattened cylinder twisted several times throughout its length and resembling somewhat an elongated corkscrew. This twist makes the fibers cling together in spinning and lends strength and durability to the yarn. Between 80 and 90 per cent of the cotton fiber is pure cellulose. The remainder is made up of water, nitrogen-free extract, protein and a vegetable fat known as "cotton wax."

Botanically, cotton belongs to the same order of plants as hollyhock, mallow and okra. It is known to botanists as *Gossypium*. There are several species of the genus *Gossypium*, but no two botanists seem to be agreed as to the number of species into which it can be divided. Some botanists recognize three or four species and some recognize over eighty. These distinctions, however, are of no importance in a commercial sense.

The cotton plant, when full grown, is usually from three to six feet high, with widespreading branches near the base, and tapering to a point at the top. It bears large leaves, somewhat resembling ivy leaves, except that—in the American varieties, at least—they are covered with a sort of hair and have a dull appearance. The flowers of the American cotton plant are generally a creamy white, with buff-colored stamens. After the flower has been opened for a day its color changes to pink and then to a deep red or magenta. The flower of the Sea Island and Egyptian varieties is usually a lemon or golden yellow, with crimson spots at the base of the petals on the inside. The flower of some Indian varieties is red.

After the flower drops off, which it does on the third or fourth day, there remains a small pod or boll, known as a "square." This develops until it becomes about the size and shape of a hen's egg. Then it bursts, revealing three to nine *loculi*, or cells, divided from each other by membraneous walls, and each containing seeds to which are attached the lint or cotton.

In the Egyptian and Sea Island varieties the lint is attached rather loosely to the seed and comes away easily and completely in the ginning. But in most American and Indian varieties the lint adheres closely to the seed, and even after ginning it leaves attached to the seed a short fuzz which is known as "linters" and is removed by a process known as "delinting." The chief use of linters nowadays is for the making of guncotton.

Cotton is an exceedingly difficult crop to handle successfully, for it requires not only a peculiar combination of climatic conditions, but the almost constant application of a large amount of labor. In the early stages of its growth the plant requires a hot, moist climate, without abrupt changes of temperature, and with frequent, but not too heavy or long-continued, rains. It also requires warm nights. Cool nights weaken the delicate growing plant and necessitate resowing. After the plant is mature and the bolls have begun to form, it needs clear, dry weather, but not excessively high temperatures.

Much rain at this stage of the crop causes stains or "tinges" which lower the value of the cotton. It also promotes the development of insect pests. Very high temperatures, on the other hand, check the development of insect pests, but cause premature opening of the bolls, with resulting damage to the cotton fiber. Frost is fatal to the crop at any stage of its growth, and early frost, while a large part of the cotton is still to be picked, often causes great loss.

So much damage is done to the American cotton crop by insect pests that a few words about them are necessary. The worst of these is the boll-weevil, which is of Mexican origin and first made its appearance in the United States in 1892. Within recent years it has spread over most of the cotton belt. The spread of this insect is favored by wet weather and open winters, while hot, dry weather kills it. The weevil makes a hole with its beak in the skin of the squares or young bolls and deposits its eggs within. When the larvæ are hatched they feed on the interior substance of the squares or bolls, causing them to drop off, shrivel up or rot.

Next in importance to the boll-weevil is the boll-worm, which

found its way into Texas a few years ago from Mexico. It originated in Egypt and was brought to Mexico through importations of Egyptian seed. The boll-worm pierces the squares or bolls and feeds on the seed. Besides destroying the seed, it severs much of the fiber, and dirties or stains the cotton. Earlier in the season it attacks the bud, and bores down through the stem, completely killing the plant. In addition, cotton is subject to damage by cut-worms, plant lice, grasshoppers, leaf-hoppers, locusts and other insects; by fungus organisms, and by various diseases, such as yellow-leaf blight, red-leaf blight, shedding, leaf-spot and so forth.

It is well to remember, in following crop reports, that conditions vary considerably in different parts of the American cotton belt. The belt stretches from Georgia on the East to California on the West, and from Texas on the South to Virginia on the North. It includes the states of Alabama, Arizona, Arkansas, California, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee and Texas. So many different kinds of soil and climate are included in this area that the dates of the crop season and the methods of cultivation are naturally not the same all over. In general, however, it may be said that the crop season lasts from five to nine months, and that the numerous operations involved in farming it require the employment of a lot of labor over most of that time.

The land is first prepared for planting by breaking it up with a plow. This is sometimes done in the spring and sometimes in the fall or winter. The next operation is known as "bedding up" and consists of making the ridges or beds in which the seed is planted. Then a furrow is run down the middle of each bed to receive the fertilizer and the seed. This process is known as "splitting middles out." The use of a suitable fertilizer is very important, as it makes a great difference in the yield of the crop. Artificial fertilizers are generally used, the nature of the fertilizer depending on the composition of the soil, the location of the land and other factors.

Subsequently the seed is planted. Planting time is usually in April, but in the extreme South of the belt planting often starts as early as the end of March, while in the extreme North of the belt it is often deferred until May. About a week after the seed is sown the young plants begin to appear.

Then the real work starts for the cotton farmer. The plants grow thickly and must be kept thinned or "chopped out" with a hoe. During this growing period the plants require warm days and nights

with plenty of moisture. But these conditions, which are favorable for the growth of the plant, are also favorable for the growth of weeds and grass; so that the farmer must keep his fields cleared by constant plowing and hoeing. As a consequence, a lot of labor has to be employed continually in cultivating the plant during the months of May and June and sometimes well into July.

From then until the cotton is ready to pick the crop is "laid by," as the saying is, and requires no further attention. But during the picking season much labor is again required, and all available hands are pressed into service. So far no machine has been devised that will pick cotton effectively.

The chief difficulty lies in the fact that the bolls mature at different times on the same plant and must, consequently, be picked at different times. On the average, a field is picked over about three times. Normally the bolls at the bottom of the plant mature first; then the bolls in the middle, and finally the bolls at the top. So we have what is known as a "bottom crop," a "middle crop" and a "top crop." Picking usually starts in August, although occasionally cotton has been picked as early as July. On the average, the picking season lasts from August to November. If the formation of a top crop is checked by excessive drought or an early frost, the picking may be finished in October, while in a very mild, open season it may last into December or even January.

The cotton is pulled from the boll by hand and dropped into a bag carried by the picker. At the end of each row it is dumped into a larger bag or basket. These large bags or baskets are weighed and loaded on wagons which carry them to the farm. Small farmers usually store the cotton in their houses until they can send it to be ginned. The larger planters often have gin houses of their own, in which the cotton is ginned immediately after it is gathered. The cotton, before it is ginned, is still attached to the seed, and is consequently known as "seed cotton." As a rule the seed constitutes about two-thirds of the gross weight of seed cotton. The remainder is cotton lint. The proportion of lint to the gross weight of seed cotton is known as the "ginning out-turn."

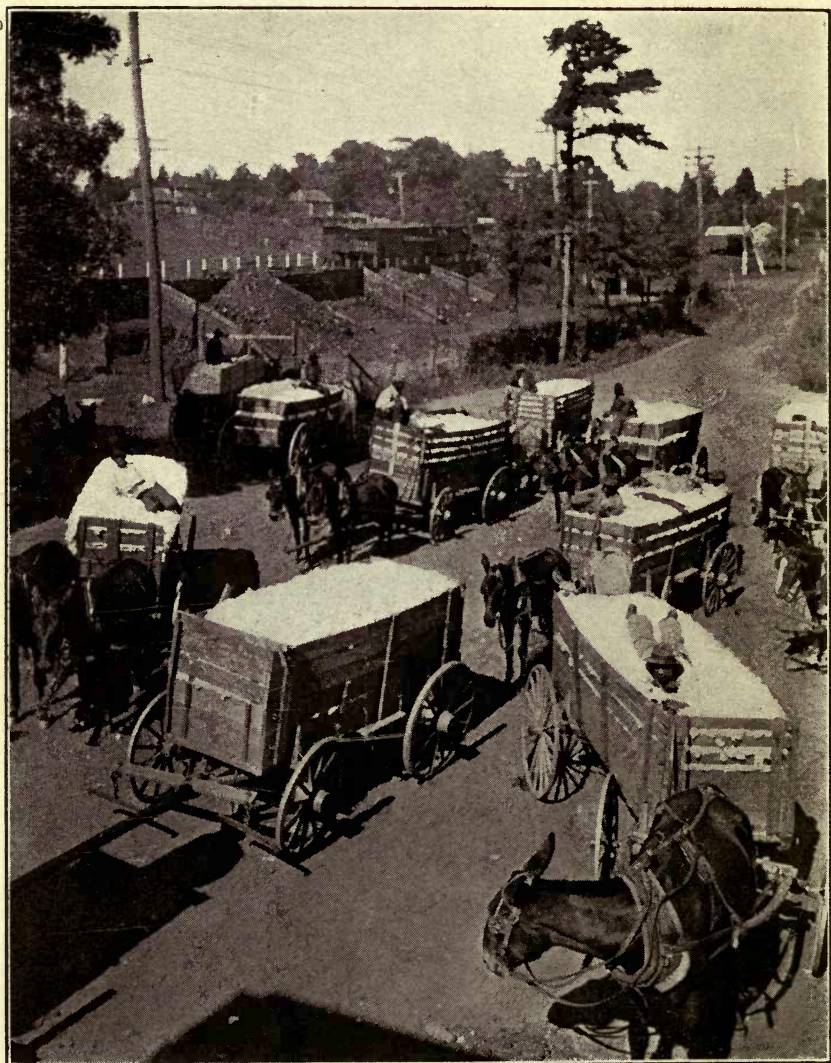
Ginning is the process of removing the lint or cotton from the seeds. At one time it was done by hand. This was an extremely slow and laborious process—so slow and laborious that it took a man about a year to do as much as a machine can now do in a day. Under such conditions the production of cotton was necessarily small. The total production of American cotton in 1790 was only

3138 bales. But with the invention of the cotton gin by Eli Whitney in 1793 the cotton industry was completely revolutionized, and thenceforth the production of cotton grew by leaps and bounds.

At first the gins were worked by horse or mule power, but later both horse and mule gave way to the steam engine. Many of the large planters, as already mentioned, maintain their own gins, but most of the cotton farmers take their seed cotton to large ginneries which are located in neighboring towns. After the cotton is ginned it is pressed and packed into bales weighing about 500 pounds each. It is then ready for market.



PICKING THE CROP IN GEORGIA. WHOLE FAMILIES, FROM CHILDREN TO GRANDPARENTS, WORK DURING THE PICKING SEASON



TAKING COTTON TO THE GIN. THE GIN IS THE CENTER OF ACTIVITY DURING THE PICKING SEASON, AS FARMERS CANNOT STORE LOOSE COTTON

CHAPTER III

MARKETING THE CROP

THERE are very many varieties of cotton known to the markets of the world. These varieties are so numerous and the classification of them is so irregular that it would be impracticable to describe them in detail. Every cotton-producing country divides its product into a number of different varieties, generally according to the districts in which they are grown, and these varieties in turn are sub-divided according to the length of staple, the seed from which they are derived, and so forth. Only a limited number of varieties, however, are familiar to the American market. These may be roughly classified under the general headings of Egyptian and American.

Several varieties of Egyptian cotton are known to the market, the most familiar being Sakellaridis (usually mentioned in market reports as Sak or Sakel), Mitafifi, Ashmouni and Abassi. The bulk of the Egyptian crop is Sakellaridis, while more than half the remainder is Ashmouni. Mitafifi used to be the most important of Egyptian varieties, but it has become of comparatively little importance in recent years. Most of the Egyptian crop is of long staple, running from 1 to $1\frac{3}{4}$ inches—the latter being the average length of Sakellaridis. The total crop averages somewhat over 1,000,000 bales.

A new and important variety of Egyptian cotton, known as Pima, is being grown in some of the irrigated districts of California and Arizona, notably in Yuma, the Imperial Valley and the Salt River Valley. The total production of Egyptian cotton in Arizona and California for the year 1919, according to the figures of the U. S. Department of Agriculture, was 42,374 bales. There is also a considerable amount of Egyptian cotton, mostly of the Mitafifi variety, grown in Peru. The annual Peruvian production of Egyptian cotton runs between 75,000 and 100,000 bales.

Egyptian cotton is used mostly for automobile tires, spool thread, lace, fine hosiery and knit underwear, fine sheer fabrics, such as nainsooks, longcloths, voiles, organdies and muslins, and fine fancy cottons, such as novelty white goods, silk mixtures and so forth. The best Egyptian cotton is the finest in the world, with the exception of Sea Island. The latter is an American cotton and gets its

name from the fact that it was first grown on the islands off the coast of South Carolina. It is also grown on parts of the mainland of South Carolina, Georgia and Florida, as well as in the West Indies, Brazil and Peru. The American Sea Island crop, however, has practically disappeared, owing to the ravages of the boll weevil. From a high point of over 120,000 bales in former years it had dropped to less than 7000 bales in 1919. The West Indian, Brazilian and Peruvian crops are also very small.

In the United States the Sea Island crop is being replaced to some extent by a new variety known as Mead cotton, which is being developed under the auspices of the Department of Agriculture. Mead cotton is a variety of what is known as Upland cotton, so-called because it was first grown on the uplands of the Atlantic States. Generally included under the head of Upland cotton are a number of other more or less similar varieties, known as Gulf, Benders, Bottom Land, Mobile, Peelers, Allan-seed and so forth. Upland cotton constitutes more than 99 per cent of the total American crop and about 60 per cent of the world's total supply of cotton. About 95 per cent of all the cotton dealt in on the American markets and about 75 per cent of all the cotton dealt in on the British markets is Upland cotton. Except when otherwise specified all cotton market reports and quotations in the United States refer to Upland cotton.

The process of marketing the American cotton crop is in most cases a very complicated one, and between the gin and the mill the cotton passes through many hands. When the farmer receives his cotton from the gin it is packed in large loose bales covered with jute bagging and bound with steel straps. These bales are known as "gin bales" and weigh about 500 pounds each, including about 20 pounds of bagging and straps.

As they are too bulky in proportion to their weight to be handled economically in shipping and warehousing, they are compressed before shipment into a smaller volume by the action of a powerful hydraulic press. These compresses are located at what are called "compressing points," which are usually the nearest shipping points. Some of the large planters have compresses as well as gins on their plantations and ship their cotton direct to a mill or a warehouse. But generally the cotton is marketed in a more roundabout way.

As a rule, the small tenant farmers live during the growing season partly or altogether on credit furnished by local storekeepers. When they receive their cotton from the gin they deliver it to the

storekeeper in payment of their debts or else sell it for cash to a local cotton buyer known as a "street buyer," or to a visiting representative of a large cotton merchant. While this is the general method it is subject to innumerable variations. In the cotton-growing districts all sorts of people deal in cotton. Cotton is the farmer's money and he is apt to use it in payment for seed or fertilizer, for rent, for goods purchased at the local store, for credit furnished by the local bank. The larger grower, on the other hand, may sell his cotton direct or ship it on consignment to a factor located in one of the important market cities, like Houston or Memphis or St. Louis. These factors are usually bankers as well, financing growers and local buyers, and they sell directly to mills, exporters and foreign accounts.

By whatever means the cotton is gathered from the grower it finds its way sooner or later to the large market towns or seaports. Here it is sampled, graded and compressed. By the time the gin bale reaches the compress it looks like the wreck of the Hesperus. It has been sampled by numerous buyers or prospective buyers, who have done their sampling by the simple process of tearing a hole here and there in the bagging and pulling out a handful of cotton. Sometimes a bale shows a greater surface of exposed cotton than of bagging. This means accumulated dirt, loss of cotton and often serious damage by weather, owing to inadequate local storage facilities. At the compress, instead of being recovered with fresh bagging, the tattered bale is simply patched by tying pieces of bagging over the holes with a few extra bands. As a consequence it gets torn open again in shipment, resulting in more loss of cotton and more damage from dirt and weather. The annual loss of American cotton through imperfect baling and inadequate storage facilities runs into very large figures; but improvement in these respects, although noticeable, is very slow.

At the compress point the buyer takes a sample from each bale and identifies it with a tag corresponding to another tag which is attached to the bale from which the sample is taken. These samples are graded under the supervision of the buyer by experts employed for this purpose. Cotton is graded with reference to a number of qualities, including length of staple, strength, uniformity, color, cleanliness and flexibility. Irregularity in the length or diameter of the staple; weak, unripe or dead fibres; bad color or lack of lustre; damage by insects, sun or frost; boll stains or tinges, and much dirt, leaves or broken seeds—all these are among

the many defects which detract from the value of cotton. Everything else being equal, the longer the staple the more valuable the cotton.

The grades for American cotton have been established by the United States Government and are invariably used in the trade. For white cotton the grades in the order of their highest value are Middling Fair, Strict Good Middling, Good Middling, Strict Middling, Middling, Strict Low Middling, Low Middling, Strict Good Ordinary and Good Ordinary. For yellow tinged stock the grades are Strict Good Middling, Good Middling, Strict Middling, Middling, Strict Low Middling and Low Middling. For yellow stained and blue stained cotton there are only three grades: Good Middling, Strict Middling and Middling.

So many things affect the grade of cotton that these standard grades are not absolutely definitive. In other words, one bale of Middling cotton may not be as good as another bale of the same grade. The best bales of Middling are likely to equal the low bales of Strict Middling, while the low bales of Middling may be no better than the best bales of Strict Low Middling. The Liverpool standards, or so-called International standards, are slightly different from the standards of the United States, but correspond to them closely enough for practical purposes. Generally speaking, Liverpool grades above Middling are slightly lower than the corresponding American grades, while those below Middling are slightly higher.

The basic grade of all Upland cotton is Middling, and all quotations are based upon it. So that when we read in market reports of 15 or 20 cent cotton it means 15 or 20 cents for Middling Upland. The other grades are quoted at so many "points on" Middling or so many "points off" Middling. A hundred points are equivalent to one cent. Thus, if Middling cotton were 20 cents and Middling Fair were quoted at "500 points on," it would mean a price of 25 cents for Middling Fair. Under the same circumstances Good Ordinary at "500 points off" would be 15 cents.

Cotton quotations are established by day-to-day trading on the Exchanges. The Exchanges are simply great central markets where buyers and sellers, or their representatives, meet for the purpose of trading in cotton. In the United States the principal cotton exchanges are those of New York and New Orleans. Abroad the chief markets are Liverpool, Bremen, Havre, Alexandria and Bombay. Outside of the United States the Liverpool market dominates the cotton world and its standards are everywhere adopted. New

Orleans is chiefly a "spot" market, which means that most of its dealings involve the actual transference of cotton. New York, on the other hand, is chiefly a "futures" market, which means that most of its dealings are in contracts for the future delivery of cotton. Liverpool is both a great "spot" and a great "futures" market.

It is the dealing in "futures" which introduces most of the speculative element into trading on the Exchanges. As a matter of fact, few of the "futures" contracts which are traded in from day to day on the Exchanges are fulfilled by actual delivery of cotton. Some of them represent purely speculative dealings in anticipation of a rise or a drop. The man who buys "futures" on speculation is really betting that prices will go up, while the man who sells them on speculation is really betting that prices will go down. But only a small proportion of the trading in "futures" is speculative. Most of it represents a practice, known as "hedging," by which manufacturers and merchants try to guard against fluctuations.

Both the spinner and the weaver have to make contracts months ahead for the delivery of their product at a specified price. This price must be figured with reference to the current cost of raw cotton, since nobody can tell what the price of raw cotton is going to be several months ahead. In buying cotton at the current market level for future delivery, against contracts for the future delivery of his product the spinner protects himself against a rise in prices which might wipe out his profits.

And in order to protect himself against a drop in prices which would make his cotton worth less than he has contracted to pay for it he sells contracts for the future delivery of a corresponding amount of cotton. In other words, he "hedges"; and whether cotton goes up or down his gains and losses balance each other. Similarly the merchant who sells cotton for future delivery "hedges" by buying "futures" for a corresponding amount of cotton. In this way the buying and selling of "futures" on the cotton Exchanges, although frequently abused by speculative interests, really serves to stabilize the market and protect the cotton manufacturer.



CHAPTER IV

A GREAT INDUSTRY

COTTON manufacturing, as already mentioned, had its beginning in India over 3000 years ago. Its introduction into Spain by the Moors in the Tenth Century seems to have been the beginning of the industry in Europe. The subsequent advance of cotton manufacturing in Europe was very slow. This development is difficult to trace owing to the general confusion of cotton and wool in the old chronicles. During the period from the Tenth to the Sixteenth Century there were important textile industries in Greece, Italy, Flanders and England. These included the manufacture of silks, woolens and linens, but whether or not they included also the manufacture of cottons it is impossible to say.

It is at least certain that until well into the Seventeenth Century cotton manufacturing in Europe had not developed to sufficient importance to compete materially with Indian cloths. Even as late as the end of the Eighteenth Century the importation of Indian cotton goods to Europe was being conducted on such a large scale that an association was formed in Edinburgh in 1775 to persuade women from wearing Indian cottons in preference to Scotch cottons.

But by this time there had grown up a very considerable cotton manufacturing industry in Great Britain, although how it started there is not quite clear. It is said that the manufacture of cotton goods was established in northern Italy in the Sixteenth Century, that it was introduced from there to the Netherlands, and that Flemish spinners and weavers, driven from the Netherlands by religious persecution at the beginning of the Seventeenth Century, introduced the industry into England. In any case we find the cotton industry firmly established in Lancashire by the middle of the Seventeenth Century.

It was in England that the great impetus was given to cotton manufacturing, and the foundations of the industry as we now know it were really laid, by the invention of the spinning jenny, the spinning mule and the power loom. Up until the middle of the Eighteenth Century the methods of cotton manufacturing were almost as primitive as they had been for centuries before. The spinning of yarn was a cottage industry, done on a spinning wheel by women

and girls. The weavers, as a rule, were skilled craftsmen who bought their yarn from the cottagers or else employed women to spin for them. Often a whole family would be engaged in the industry—the men doing the weaving on hand looms, the women and elder girls doing the carding and spinning, and the children picking the cotton.

At first the weavers sold the cloth to merchants. Later the merchants, to quote an English authority, "began to give out warps and raw cotton to the weavers, receiving them back in cloth, and paying for the carding, roving, spinning and weaving." Later there arose a class of middlemen, called "fustian-masters," who furnished the weaver with the warp and raw cotton, paid him for the spinning and weaving, and received in return the gray or unfinished cloth, which they sold to the merchant. The merchant, in turn, had this cloth dyed and finished, and sold it to the mercers or retailers. Under these conditions the cotton manufacturing industry gradually spread until it became a factor of considerable importance in the economic life of England. But its development was retarded by the limitations of the spinning wheel.

The old hand loom, although primitive enough, was a more advanced machine than the spinning wheel and was improved more rapidly. In 1738 the flying shuttle, a device for driving the shuttle through the warp mechanically instead of by hand, was invented by John Kay, a native of Bolton, Lancashire. His son, Robert, invented in 1760 a device known as a drop box, to hold several shuttles with threads of different colors, which made possible quicker changes in weaving cloths of more than one color. In the latter year a new kind of loom, known as the swivel loom, was introduced into England from Holland. This made possible the weaving of several narrow pieces of cloth at the same time. Soon afterward came the harness-loom for weaving figured goods, which was superseded later by the Jacquard loom.

As a result of improvements in the loom, weavers found it difficult to get enough yarn to keep them busy, and attention was turned toward improvement in the spinning wheel. The first and most revolutionary improvement came in 1764, when James Hargreaves, a laborer of Blackburn, Lancashire, invented the spinning jenny, a machine which twisted several threads at one time where the old spinning wheel twisted only one. An improved jenny, capable of spinning a harder yarn, was invented in 1769 by a barber named Arkwright, who lived in Preston, Lancashire. Both types

of jenny were used in England until they were superseded by the spinning mule, an invention of Samuel Crompton of Bolton.

The spinning mule with various improvements is still in general use, although in the United States it has been supplanted to a large extent by the ring spinner, an invention attributed to an American named James Thorpe in 1828. The ring spinner is very much more rapid and economical than the mule spinner, but it is generally conceded that the latter spins softer and more even yarns. Mule spindles still predominate in England, but the ring spindle is making rapid headway there.

Improvements in the spinning machine eventually made necessary further improvements in the loom, and in 1787 the power loom was invented by Edmund Cartwright, an English preacher. This invention was adopted very slowly, but by degrees the old hand loom was eliminated and the power loom improved until to-day it has become an automatic machine of high efficiency. Numerous inventions have served to bring the loom to its present state, the most important of them perhaps being the Northrup automatic loom, invented by an Englishman named James Northrup, but taken up and developed by an American firm.

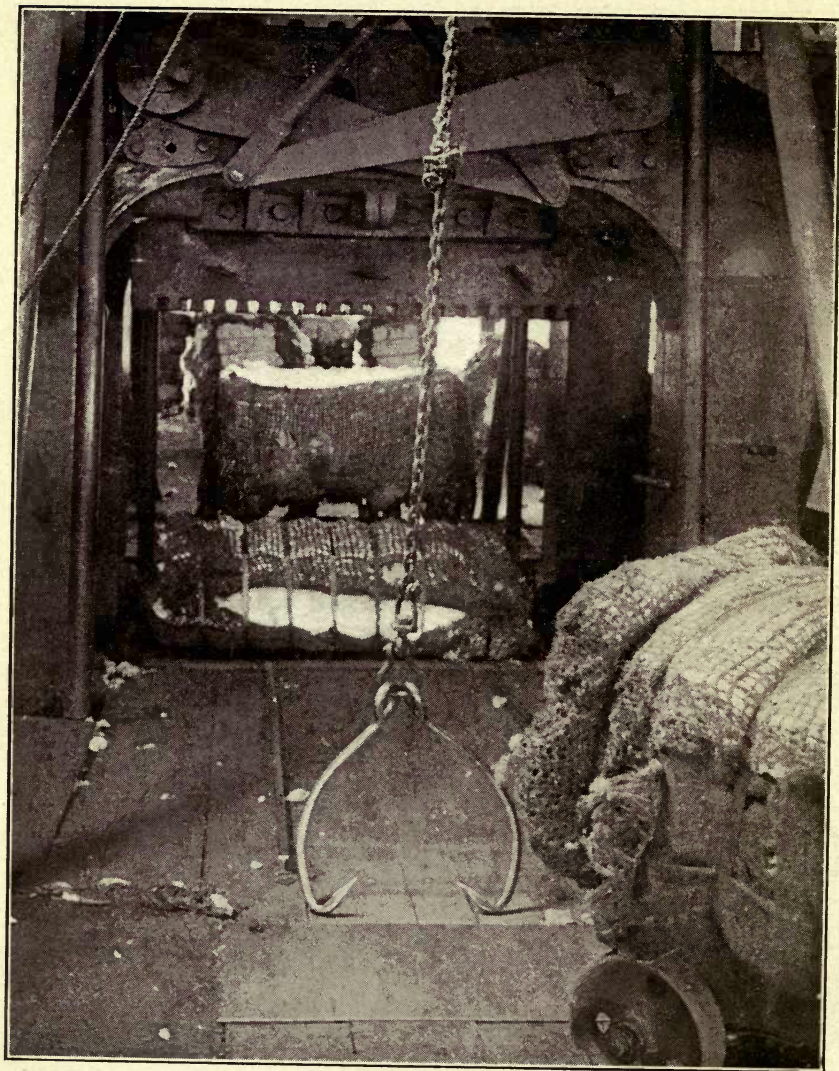
From its modest beginnings the English cotton industry grew rapidly until England became the greatest cotton manufacturing country in the world. In the middle of the Eighteenth Century there were about 30,000 people engaged in the cotton manufacturing industry in and around Manchester. At the present time there are in Lancashire about 500,000 people directly engaged in the spinning and weaving of cotton. And when it is remembered that one person at a modern spinning frame or power loom can do as much work as many persons did with the old spinning wheel or hand loom, it can easily be realized what a tremendous expansion these comparative figures of employment represent.

The English cotton industry is still located chiefly in Lancashire, although there is also some cotton manufacturing done in Yorkshire. Scotland has a considerable cotton manufacturing industry in the counties of Ayr, Renfrew and Lanark. The principal cotton manufacturing cities of England are Oldham, Bolton, Manchester, Rochdale, Stockport, Preston, Leigh, Burnley and Blackburn. Manchester continues to be the world's greatest market for cotton cloth and Liverpool the world's greatest market for raw cotton.

But the predominant position in the cotton industry so long held by Great Britain is rapidly being taken away from her by the United



IN THE COTTON GIN. HERE THE SEED IS REMOVED AND THE COTTON
PRESSED INTO BALES



VIEW OF A COTTON COMPRESS, SHOWING THE POWERFUL PRESS THAT
CONDENSES THE COTTON INTO COMPACT BALES FOR SHIPPING

States. As far as we know, the first cotton factory in the United States was one built at Beverly, Mass., in 1787. This enterprise failed, owing to the inadequacy of the machinery used. In 1790, however, Samuel Slater, who had become familiar with the Arkwright machinery in England, built a mill at Pawtucket, R. I., with machinery constructed on the Arkwright principle. This machine was driven by a water-wheel and was known as a water-frame. It contained twenty-four spindles. These twenty-four spindles were, so to speak, the ancestors of almost 35,000,000 spindles now employed in the American cotton industry.

During the fifty years following the establishment of Samuel Slater's mill, cotton manufacturing grew rapidly in America. We quote from a book called "The American Cotton Spinner," written by Robert H. Baird and published in 1851: "Since this first machinery was in operation, the advancement and extension of the cotton manufacture is truly astonishing; it has caused hundreds of populous cities, towns and villages to spring up, as if reared by some magic influence, where, a few years ago, nothing was seen but a barren wilderness. The cotton manufacture continued to spread from this time up to the War of 1812, which gave the manufactures a strong impulse.

"There were several mills in Rhode Island in 1807. . . . In this year the Globe mills, in Philadelphia, were erected. . . . In 1812, there were in Rhode Island thirty-three cotton factories, containing 30,663 spindles. In Massachusetts there were twenty mills, with 17,371 spindles." In 1819 a group of Boston men erected the first factories at Lowell, Mass., which was then "a poor barren district, containing but a few houses, and inhabitants, who supported themselves principally by fishing in the Concord and Merrimack rivers." In 1840, according to this authority, there were in the United States about 1025 cotton mills, containing 2,112,000 spindles and consuming 106,000,000 pounds, or about 200,000 bales, of cotton annually. Of these 2,112,000 spindles nearly 1,600,000 were in the States of Massachusetts, Rhode Island, New Hampshire, Connecticut and Maine. In 1850 the number of spindles operated in the United States, according to a recent estimate, was about 3,500,000. By 1920 the industry had expanded until it operated 34,700,000 spindles.

New England is still the most important cotton manufacturing center of the United States, although it is gradually being superseded by the South. In New England the industry is located chiefly

in and around the cities of Fall River, New Bedford, Lowell and Lawrence, Mass.; Providence, R. I., and Manchester and Nashua, N. H. In the South it is located chiefly in South Carolina, North Carolina, Georgia, Alabama and Virginia. The growth of manufacturing in the South has been extraordinarily rapid. As late as 1880 the South consumed only 188,748 bales of cotton, as against 1,129,498 consumed by New England. At present the South consumes annually nearly a million bales more than New England. On the other hand, New England possesses more spindles and produces a greater yardage of cloth. This apparent contradiction is accounted for by the fact that the production of the Southern mills includes a higher proportion of heavy cottons than the production of the New England mills. The total American consumption of cotton for the season 1919-20, as estimated by Shepperson's "Cotton Facts," was 6,759,631 running bales, including linters. Of this amount the Southern mills took 3,589,675 bales and the Northern mills 2,835,669 bales. Out of a total of 34,700,000 spindles in the United States in 1920 the North had 19,600,000 and the South 15,100,000.

The relation of the South to the North in cotton manufacturing parallels rather closely the relation of the United States to England. In other words, cotton manufacturing in the United States is growing faster than in England, and it already consumes a greater quantity of raw cotton and produces a greater poundage of cloth, but it is still behind in the number of spindles employed and the number of yards of cloth produced. Similarly England is still ahead of the United States in the production of fine goods. The total number of spindles in Great Britain in 1920 is estimated at 57,300,000, as compared with 35,700,000 in the United States. The consumption of cotton by the British mills for the season 1919-20 was approximately 3,700,000 bales of 500 pounds each, as compared with 6,542,000 bales by the mills of the United States.

The average production of piece goods during the years 1910-13 is estimated at 1,900,000,000 pounds in the United States and 1,400,000,000 pounds in Great Britain.

This estimate of piece goods production is taken from a report compiled by the Research Committee of the National Council of Manufacturers, which shows the average world production of cotton goods by weight during the years mentioned. The total average production is given as 7,816,500,000 pounds. Of this total the United States produced 24.4 per cent, Great Britain 18.0 per cent, Russia 8.7 per cent, Germany 8.3 per cent, India 6.8 per cent, France 4.5

per cent, Japan 4.4 per cent, Italy 4.0 per cent, Austria-Hungary 3.8 per cent, and all other countries together 17.1 per cent. These proportions have been changed to some extent since the war disrupted European industry.

There are no available statistics showing the relative production of the different countries of the world at present, but it is approximately indicated by the following figures, taken from Shepper-son's "Cotton Facts," showing the consumption of cotton for the season 1919-20: United States 6,542,000 bales, Great Britain 3,700,000 bales, the European Continent 3,660,000 bales, Japan 1,825,000 bales, India 1,646,000 bales, Canada 220,000 bales, and all other countries 1,200,000 bales. The most important changes to be noted in the relative position of the different manufacturing countries since before the war are the increased importance of Japan and India, the cession to France of the German mills located in Alsace, the appearance of Poland and Czecho-Slovakia as independent countries with important cotton manufacturing industries formerly belonging to Russia and Austria-Hungary, and the breakdown of Russian production through revolution.

CHAPTER V

THROUGH THE SPINNING MILL

RAW cotton, as previously explained, is bought by the spinner from the cotton merchant or grower either direct or through an exchange broker. The spinner is the person or firm that converts the raw cotton into yarns. Some large manufacturing firms conduct all the processes involved in the turning of raw cotton into finished cotton cloth; but, as a rule, spinning, weaving and finishing are three distinct and independent branches of the cotton manufacturing industry.

In buying his cotton the spinner must have in mind a number of important considerations, the chief of which are: (1) The amount of cotton he is likely to need for a definite period ahead; (2) the possible fluctuations in the price of cotton during the period for which he must cover his needs; (3) the varieties of yarn which he proposes to make.

The last-named consideration is of special importance. Every grade and variety of cotton has a distinctive spinning quality of its own, and the same grade and variety of cotton will often vary in spinning quality according to the conditions under which it has been grown and stored. But the spinner is under the necessity of maintaining a fixed and constant quality in his yarns, and in order to do this he must exercise great care and skill in the purchasing of his cotton.

The cotton arrives at the mill in closely packed compress bales. After the iron bands and the wrappings have been removed the cotton is found to be packed into big, hard lumps, which must be broken up. This is done by a machine known as a bale breaker. From the bale breaker the cotton passes to another machine called the bale opener, which breaks the cotton up into still finer pieces and removes a good deal of the dirt, leaves or other foreign substances which may be clinging to the fiber. Then the cotton is usually conveyed to a mixing bin, where the different kinds of cotton are mixed in the right proportion to produce the kind of yarn that is desired. As already mentioned, a spinner must maintain a constant quality in his yarns, particularly if he is making yarns for well-known standard cloths, which owe a good deal of their reputation to their unvarying quality. He cannot always get the kind

of cotton he needs for his purpose in sufficient quantity or at a practicable price, and consequently it is often necessary for him to mix several different kinds of cotton in order to get the result he aims at.

From the mixing bin the cotton passes to a machine, called a picker, which loosens up the cotton and delivers it in a soft, flat sheet, known as a lap. The lap, as it comes from the picker, looks like a sheet of absorbent cotton such as is sold in drug stores. Thence it passes to other machines, called the intermediate picker and finisher picker, which loosen up the fibers still more and beat out of the cotton whatever dust or other foreign matter may be still adhering to it. If the cotton is very dirty it is also passed through additional machines called scutchers, which subject it to further beating and shaking.

The laps of cotton, which are delivered from the pickers or scutchers, are still not altogether free from foreign matter, such as bits of sticks and leaves, and the fibers are more or less tangled up. In order to remove whatever impurities may remain, as well as to straighten out the fibers and eliminate knotted, immature or too short fibers, the cotton is put through the carding machine. What the carding machine does, in brief, is to comb out the laps of cotton, lay the fibers approximately parallel to one another and condense the lap into a soft, untwisted rope, which is called a sliver. This rope or sliver of cotton is delivered from the carding machine in loose coils into a large can.

If the cotton is going to be spun into fine yarns or into coarser yarns of exceptional smoothness and regularity it is subjected to a further process known as combing. The combing machine simply does over again, and much more thoroughly, what the carding machine has already done. It subjects the fibers to a very fine combing, eliminates the shorter ones and delivers a sliver of greater smoothness and uniformity than that which has been delivered from the carding machine. The first cotton combing machine, by the way, was invented by a native of Alsace, named Heilmann, and was patented in 1845.

After leaving the carding or combing machine, as the case may be, the slivers are taken to the drawing frame. Here six or eight of them are combined into one sliver, which is passed through several pairs of rollers and is drawn out until it is about the diameter of one of the original slivers. Thence it passes to the fly frame or slubbing frame, where it is drawn out into a still smaller diameter

and given a slight twist, so that it can be subjected to more strain without breaking. After leaving the slubbing frame the sliver is known as a slubbing or slub. It is then put through the intermediate frame, which draws it out still more, gives it a further twist and winds it on spindles.

The slubbings from the intermediate frame go to the roving frame, which combines two of them into one, twists them some more and winds them on spindle tubes. In the case of very coarse yarns the slubbings go direct from the slubbing frame to the roving frame. After leaving the roving frame the slubbings are known as rovings, and in this condition they are ready to be spun. In the case of very fine yarns, however, the rovings are drawn out still further in a jack frame before being spun. The jack frame simply carries to a finer point the process already performed by the roving frame.

The rovings are spun into yarn on a spinning machine. There are two distinct types of spinning machine in use—namely, the mule frame and the ring frame. Both of these do the same things to the roving: they draw it out, twist it into yarn and wind the yarn on spindles. The difference between them is that the mule frame does these three things consecutively, while the ring frame does them simultaneously. Because of its slow, easy motion the mule frame is not so hard on the yarn as the ring frame, and is, therefore, more adapted to making very soft yarns and very fine yarns. The ring frame, which is much more rapid and economical, is best adapted to the making of medium yarns. Ring frames are used almost exclusively in the spinning mills of the United States, while mule frames still predominate in England.

Yarn comes from the spinning machine wound on cones, tubes or bobbins. It is frequently marketed in this form, but more generally it is put up for shipment in skeins. Cops, which often appear in market quotations, are cylindrical coils of yarn with tapering ends, produced on mule spindles. Warp yarns are sometimes shipped in balled or looped chains, or wound on beams or rollers.

All yarns are roughly divisible into two classes: warp yarns and weft or filling yarns. The former must be hard-twisted and strong, because they must bear a good deal of strain during the weaving process, while the latter have to undergo little strain during the weaving process and are consequently more loose and less twisted. Warp yarns have to undergo considerable preparation before they are ready for the loom, but as this is usually done in the weaving mill it will be described in the next chapter. Frequently both warp

and filling yarns are dyed, bleached or subjected to some other finishing process, such as gassing or mercerizing. These processes will be described later.

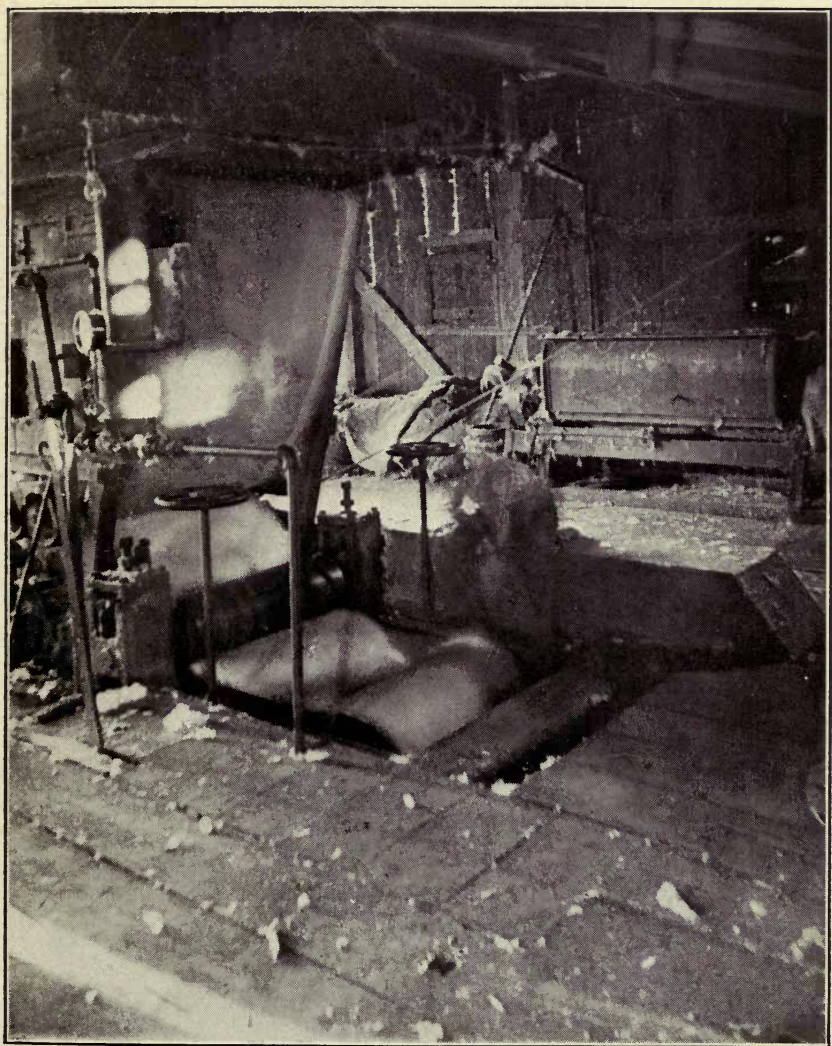
For market purposes yarns are graded primarily according to the number of hanks of 840 yards each that weigh one pound. For instance, a yarn weighing 840 yards to the pound would be known as No. 1, or simply 1's; a yarn weighing 1680 yards to the pound would be known as No. 2, or 2's; a yarn weighing 8400 yards to the pound would be known as No. 10, or 10's, and so on. These numbers are referred to as the count, and we speak of low count, high count and medium count yarns. Obviously the higher the count the finer the yarn. Thus a pound of 100's yarn would contain 84,000 yards. According to the classification made by the United States Bureau of the Census coarse yarns include 20's and under, medium yarns include 21's to 40's, and fine yarns include 40's and over.

Yarns are spun for commercial purposes as high as 400's, but counts above 200's are used only in the finest kind of lace specialties. Not very many woven fabrics are made from yarns finer than 100's and few of them are made from yarns finer than 80's. Counts higher than 80's are rarely seen in market quotations. More than 90 per cent of the yarns spun by American mills are under 40's, and, while some American mills are equipped to spin as high as 200's, they rarely spin above 80's. Weft or filling yarns, being softer and weaker than warp yarns, can be spun from a fourth to a half finer. Thus, a cotton that would spin about 100's warp yarn would spin about 150's filling yarn.

Consequently yarn quotations must specify not only the count but also whether it is warp or filling yarn. In addition, they must specify whether it is a single yarn or a 2-ply or multiple-ply yarn. As it comes from the spinning machine the yarn is a single yarn. Two single yarns twisted together make a 2-ply yarn; three single yarns twisted together make a 3-ply yarn, and so forth. Market quotations, furthermore, carry other additional descriptions of the yarn, such as the kind of cotton from which it is made, the district in which it is made, the manner in which it is put up, and so forth. For example, a typical quotation would be for Southern combed peeler skeins, 2-ply 30's. This would mean combed 2-ply yarn weighing 25,200 yards to the pound, made in Southern mills from peeler cotton and put up in skeins. A quotation for 10's Eastern carded cones would mean a carded yarn weighing 8400 yards to the pound, made in an Eastern mill and wound on cones. If it is

remembered that the count of the yarn multiplied by 840 gives the number of yards to the pound, that the terms skein, cone, chain and cop refer to the way in which the yarn is put up for shipment, and that the other terms are descriptive of the kind of yarn offered, it will be easy to understand the meaning of all yarn quotations.

It would be impossible to indicate precisely just what kind of goods are made from the different counts of yarn, because yarns of any given count may vary materially in quality and because different qualities of a certain cloth—a percale, for instance—are made from different counts of yarn. It may be said, however, that the bulk of the staple cottons sold over the retail counter—such as prints, percales, gingham, shirtings, fine sheetings, sateens, lawns, muslins, nainsooks, and so forth—are made from yarns counting from 25's to 40's in the warp and 35's to 60's in the filling. Most of the heavy cottons, like denims, tickings, ducks, drills and heavy sheetings, are made from yarns counting under 10's in the warp. Yarns counting higher than 40's go into fine sheer goods, silk mixtures and other fancies, while only the very finest kind of sheer and mercerized cottons will take yarns as fine as 80's. Yarns counting above 80's are used chiefly for lace, sewing thread, fine hosiery, gloves, hand-knitting, electrical insulating, and for wool, mohair or silk mixtures. Voile and crêpe yarns are in a separate category by themselves, as they require a special kind of twist.



PACKING COTTON INTO CYLINDRICAL BALES



SHIPPING COTTON IN TEXAS

CHAPTER VI

FROM YARNS TO GRAY GOODS

EXCEPT where spinning and weaving are both done by the same firm, yarns are bought by the weaver either direct from the spinner or from merchants who make a specialty of the purchase and sale of yarns. There is an open market on yarns, just as there is on raw cotton or cloths, and quotations are apt to vary from day to day, usually following pretty closely the fluctuations in the raw cotton market. Most yarns, of course, like most cloths, are made on order. This is particularly true of special yarns for fancy cloths. But a certain amount of yarns in standard counts are made for stock or to avoid a shutdown during dull periods; so that there is always a spot market for yarns.

Before buying his yarn the weaver naturally has to determine the kind of goods he is going to make. He buys his yarns accordingly and they are delivered to him in skeins, cones, cops or otherwise, as already explained. The width and construction of the cloth determine the number of warp threads—or ends, as they are called—which he will need to put on the loom. The warp threads, or ends, are those which run lengthwise of the fabric. They are stretched taut in the loom and shuttles containing the weft or filling thread pass over and under them, thus weaving the cloth. The filling threads are usually referred to as picks. The cloth about to be woven may be a 27-inch 64 x 60 print cloth. That is to say, it may be a cloth 27 inches wide, containing 64 warp threads, or ends, and 60 filling threads, or picks, to the square inch. It will, therefore, require 64 multiplied by 27—or 1728—warp threads.

So the yarn from the skeins or cones or cops, as the case may be, is wound on 1728 spools by means of a machine called a spooler. These spools are then placed in a large frame, called a creel, where the yarn is unwound from them and wound regularly and evenly on a beam, called the warp beam. This process is known as warping. Before the warp yarns are placed in the loom they are usually immersed in a sizing solution in order to give them more strength, stiffness and smoothness. In passing through this solution they are unwound from the warp beam and rewound on another beam, called the weaver's or loom beam. This beam is placed in position at the back of the loom. The ends of the warp yarn are passed through

the harnesses and reed, and fastened to the taking-up roller in front. In the meantime the filling yarns, or picks, have been wound from the skeins or cones and rewound on small bobbins which are placed in the shuttles on the loom. The loom is now ready to start weaving.

The variety of operations performed by a loom in weaving a piece of cloth depends upon the nature of the weave. In the case of a fancy weave these operations are often bewilderingly intricate. Reduced to its simplest terms, however, the process of weaving may be described briefly as follows: The shuttles fly back and forth, weaving the weft threads under and over the warp threads as the latter are raised and lowered by the harnesses. After each passage of the shuttle the reed is carried forward, pushing the weft thread into place—thus tightening up the weave, so to speak. According as the cloth is woven it is drawn off and rolled by the taking-up roller.

In the modern mill all the weaving operations are performed automatically. The modern loom includes devices for automatically stopping the loom when a warp or weft thread breaks and for automatically recharging and threading the shuttles when the weft threads break or are exhausted. In the United States the most widely used automatic loom is the Northrup loom. Fancy cloths of intricate weave and design are usually woven on Jacquard looms. The operations of the Jacquard loom are controlled automatically by perforated cards, punched according to the design—somewhat after the manner of a player-piano.

With certain exceptions, which will be referred to later, most cotton cloths come from the loom in a rough, unfinished state. They are of a dirty yellow-gray color, contain a number of impurities, and are rather sticky from the sizing with which the warp yarns have been treated. In this state they are known as gray goods. Some mills have their own finishing departments and finish their own gray goods; but as a rule the finishing processes are conducted by independent firms which bleach, dye, print or otherwise finish gray goods on contract either for commission agents representing mills or for middlemen known as converters.

The converter is a very important factor in the cotton goods trade and the one who assumes, perhaps, the major share of its risks. He furnishes the new styles, and, according to his judgment of what will be in demand—reinforced to some extent by advance orders from jobbers, cutters and retailers—he orders his gray goods from the weaving mill. These he has sent to a finishing plant to be

finished in accordance with his ideas. So that, in a sense, the weaver and finisher are both really contractors for the converter. Often the converter is the selling agent for a number of mills and practically their banker. He sells to the cutting-up trade, the jobber and the retailer. Some jobbers are also converters.

While the gray goods mills usually weave on contract for the converter, they very often make goods for stock in order to keep the plants running. These goods are disposed of either through mill agents or through a class of merchants known as gray goods brokers. Besides handling spot goods, the gray goods brokers frequently act as intermediaries between the converter and the mill, buying for the former on a small commission. As these brokers are in constant touch with the mills, and know from day to day what the mills have to offer and at what prices, it is most convenient for mills and converters to transact business through them. So, just as there is an open yarn market, there is also an open market for gray goods, subject to constant fluctuations.

Since the gray cloth market follows closely the fluctuations in yarns and raw cotton, and since it is directly influenced by the demand for finished goods, it is a fairly reliable indication of the trend of the cotton goods market as a whole. It should be borne in mind, however, that gray goods brokers, like cotton brokers, are apt to buy and sell goods on speculation; so that in periods of speculative activity the rise and fall of prices on the gray goods market is not always a sure guide to the real condition of supply and demand. But, with this reservation, the movement of prices in the gray goods market generally prefigures pretty accurately the movement of prices in finished cottons and is, therefore, worth watching by those who wish to follow the general market trend.

Gray goods are quoted in the market according to width, weight, count or construction and general character. The count or construction of a cloth means the number of warp threads, or ends, and the number of weft threads, or picks, to the square inch. A typical example is the 38½-inch, 5.35-yard, 64 x 60 print cloth, which is generally used as a basis for market quotations in much the same way as middling upland is used for raw cotton quotations—although it might better be described as a standard market indicator. This is a print cloth 38½ inches wide, weighing 5.35 yards to the pound, and containing 64 ends and 60 picks to the square inch. Print cloths are so called because they are used chiefly for printed goods, such as prints and percales.

It is important to remember that the construction of a cloth does not define its character or value. Thus a 64 x 60 might be a print cloth, a voile or a twill. The character of the cloth depends not only on the construction but on the weight and quality of the yarns. Generally speaking, the higher the construction the higher the count of the yarns used in it; and, as already explained, the count—also generally speaking—indicates the quality of the yarn. But there are many exceptions to this. For example, an *éponge*, which is a comparatively expensive cloth, may be made in a 66 x 24 construction. This is a very low construction as to the pick; but it is due to the special character of the cloth, which calls for a very soft filling yarn of good quality, especially made for the purpose. Napped goods, to cite another example, are usually made with a soft, low-count filling yarn—less than 16's—in order to permit of napping. Making allowance for such exceptions, the construction of a cloth indicates roughly its quality.

Gray goods are divided into six main classes: Print cloths, from which the staple printed fabrics are made; sheetings; sateens; twills; combed yarn goods, from which are made fine fabrics like lawns and dimities; and fancies, such as silk mixtures. There are various other cloths which do not come under any of these heads, but these are the chief classes of gray goods quoted in the market. Heavy cottons, such as ducks, drills, denims and tickings, are usually quoted by weight. Print cloth constructions vary from 44 x 40's to 80 x 80's, and their weight varies from four yards in the pound to 10.55 yards in the pound. Sheetting constructions run from 44 x 40's to 56 x 60's and the weight runs from 2.85 to 6.15 yards in the pound. Combed yarn cloths will run from 76 x 72's to 96 x 100's or higher, while sateens will run from 64 x 72's to 72 x 120's. The most familiar twill constructions are 64 x 64, 68 x 76 and 96 x 64. Fancies are usually of high construction, such as 96 x 96 or 96 x 100.

Given the width, weight and construction of a cloth it is easy to determine roughly the count of yarn used in it. The number of ends and picks in a square inch, multiplied by the width of the cloth, gives the number of yards of yarn in a yard of the cloth. To this must be added about 10 per cent to allow for take-up of the yarn in weaving. Multiplying the number of yards of yarn in a yard of cloth by the number of yards of cloth to the pound, we get the number of yards of yarn in a pound of the cloth. Dividing this by 840, as explained in the preceding chapter, we get approximately the count of the yarn. Thus we would find that a 38½-inch, 5.35-

yard, 64 x 60 print cloth would contain about a 29's yarn. This is near enough for a rough-and-ready calculation.

As already mentioned, the 64 x 60 print cloth, either in the 27-inch or 38½-inch width, is generally taken as the standard market indicator, and prices on this construction over a given period will reflect pretty closely the general trend of the market. Fall River and New York are the principal gray goods markets. It is well to bear in mind that prices in the New York market are often quoted on Southern goods or goods in second hands and are apt to be lower than New England mill quotations.

CHAPTER VII

THE BASIC WEAVES

AS already explained, the character of a piece of cotton goods is determined largely by the count of the yarn and the construction of the cloth. But for the purpose of general classification there is a still more fundamental distinction, and that is the nature of the weave. All kinds of woven textiles, including cotton goods, are loosely classified under eight main heads, according to the manner in which they are woven. This classification may be stated as follows: Plain weaves, twill weaves, satin weaves, figured weaves, pile weaves, gauze or leno weaves, lappet weaves and double-cloth weaves.

Any one of these classifications may include many different qualities of cloth, and any one of them may be varied so as to produce a large variety of different effects. But in judging the character of a piece of cloth the first thing to do is to determine the nature of the weave, and this, as a rule, can be done very easily by simply looking at it either with the naked eye or through a magnifying glass.

The most important and the most common of all weaves is the plain weave. In plain weaving the weft or filling thread is passed at right angles over and under alternate warp threads. This produces a smooth, plain cloth of fairly open texture. The closeness of the texture and the smoothness of the surface depend to a large extent upon the kind of yarns used, as well as on the nature of the finish.

But generally the texture of a plain woven cloth is sufficiently open to permit one to note on close examination how each thread passes over and under alternate threads. A variety of patterns can be introduced in this weave by using yarns of different sizes or yarns dyed in different colors. For instance, corded effects in stripes or checks may be produced by varying the size of the yarns in the warp or weft or both. Colored stripes are produced by using bands of dyed yarns in the warp, and checks and plaids are produced by using dyed yarn in the warp and filling. Obviously it is possible by using dyed yarns to obtain an almost unlimited number of different colors. The plain weave is used for a large proportion of the familiar staple cotton goods, including prints, percales,

ginghams, sheetings, muslin, batiste, longcloth, cambric, voile, organdy, lawn, mull, nainsook, outing flannel, seersucker, shirtings, etc. Poplins, piqués and Bedford cords are also plain weaves as a rule, the corded effect being obtained by using larger yarns.

Next in importance to the plain weave is the twill weave, which may be distinguished by the fact that it produces lines or ribs running diagonally across the cloth. Serge is the outstanding example of this kind of weave, but it is also used very largely for cotton goods. In the twill weave the filling threads do not pass over and under the warp threads at regular intervals, as in the plain weave, but at irregular intervals of two, three, four, five or more threads. For instance, the filling threads might pass over one warp thread and under three, four, five or six, or they might pass over two and under one, two, three or four. Every time the filling shuttle goes through it passes over and under a different set of warp threads. This is what gives the diagonal rib effect.

The combinations of this weave can be varied almost indefinitely, so as to produce not only diagonal rib effects but curved, waved and zig-zag ribs, such as herringbones. Additional effects can be introduced, as in the plain weave, by using yarns of different sizes or dyed yarns of different colors. The original and principal purpose of twill weaving is to make a strong heavy cloth, for it is possible in this way to weave a closer, firmer texture than in the plain weave. Thus its most familiar examples in the cotton trade are such goods as tickings, drills and jeans. But it is also used largely to produce various patterns, such as herringbones.

The satin weave is really a variation of the twill weave, except that it is done in such a way as to conceal the twill structure and produce a very smooth surface. This effect is obtained by passing the filling threads over or under a large number of warp threads—anywhere from six to twelve. If, for example, the filling threads are passed under one warp thread and over eight or ten, the result is that most of the filling is on the face of the cloth. Such cloths are called filling-face satin weaves. If, on the other hand, the filling threads are passed over one warp thread and under six or eight warp threads, the result is that most of the warp is on the face of the cloth. These are called warp-face satin weaves.

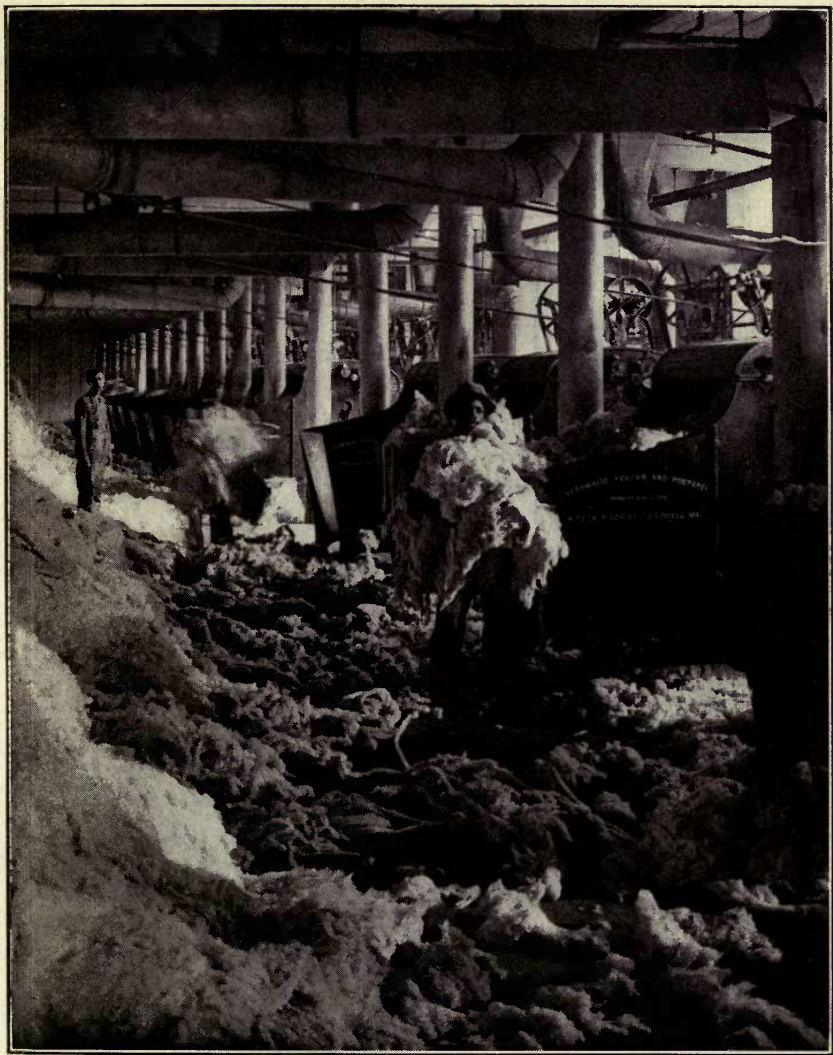
In all satin weaves the interlacings of the warp and filling threads are arranged at irregular intervals, so that no sign of a line or twill appears on the face of the cloth. While the satin weave is, of course, most common in silk, it is also used to a large extent in

cotton goods. Various kinds of cotton goods made with this weave are familiar under the general name of sateen. It is used, as well, for cotton-filled worsteds, showing practically all the worsted warp on the surface, and for cotton-warp silks, showing practically all the silk filling on the surface. The latter cloth is often referred to as a cotton-back satin.

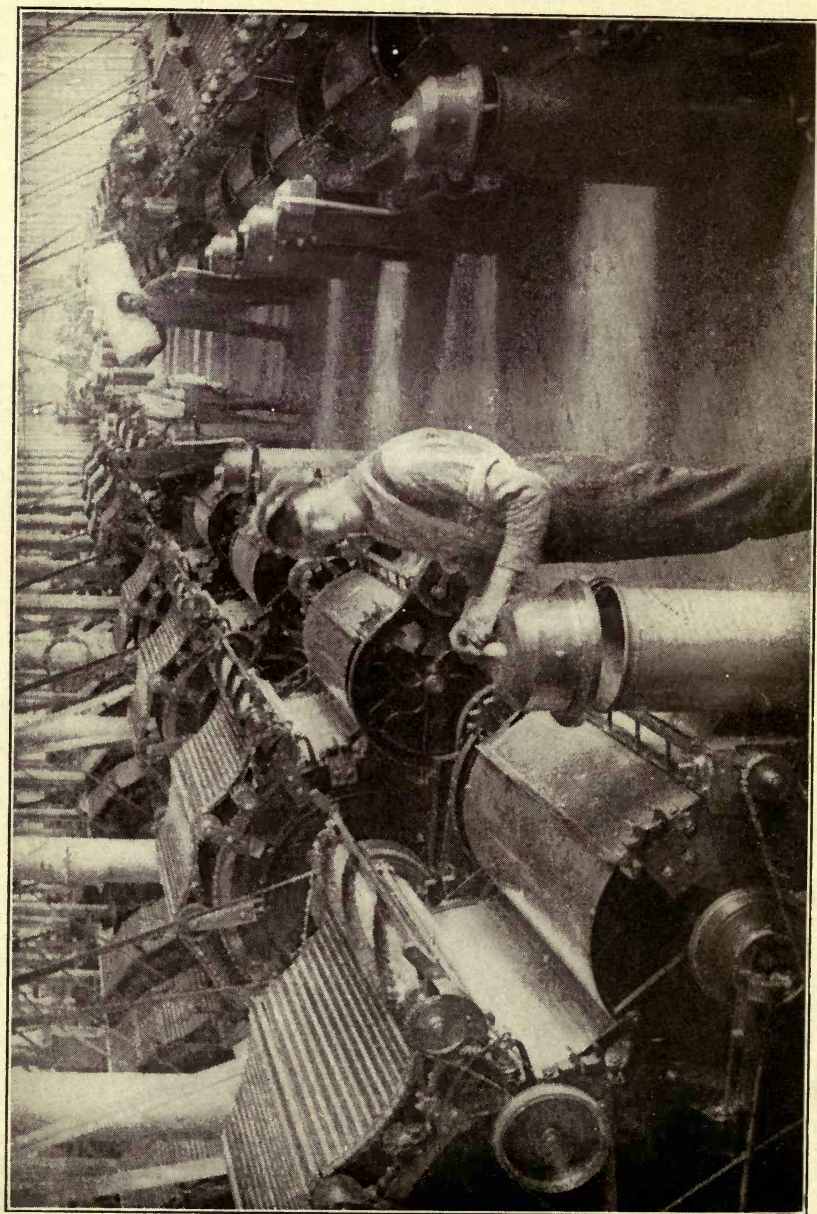
Figured weaves are the most intricate of all, and are susceptible of endless variations. As the name indicates they are used to achieve figured patterns in the cloth—usually elaborate and complicated patterns, as the more simple patterns can be obtained by more simple means. A typical example of a figured weave is a silk brocade. It is often called a Jacquard weave because it is done on a Jacquard loom. The operations of this loom, as pointed out in a previous chapter, are controlled by perforated cards, something after the manner of a player piano. The Jacquard can weave anything, from a plain fabric to the most elaborate brocade, but it is usually employed only to weave the most intricate patterns. Less intricate patterns are woven on dobby looms, while plain, twill and satin weaves are woven on plain looms. The best example of a figured weave in cotton goods is a cotton damask.

The pile weave is not, strictly speaking, a separate weave, although it is generally referred to as such, but is a variation of the plain weave. There are various ways of weaving a pile fabric, the most common being what is known as a warp pile. In weaving a warp pile fabric an extra set of warp threads is introduced. These are formed into loops, as the weaving proceeds, by being carried across wires laid parallel to the filling threads. Subsequently the loops are either left on the cloth as they are, or they are cut open at the top. In the latter case the goods are then sheared in order to make the pile smooth and even. Another way of weaving a pile fabric is with what is known as a weft pile. In this method extra filling threads are placed in the shuttles. These are not carried all the way across the cloth, like the regular filling threads, but are floated to the surface at intervals, making a loose pile which is subsequently sheared.

Still another way of making a pile fabric is by means of a double-cloth weave, which will be described later. Familiar examples of pile fabrics are plushes, velvets, velveteens and corduroys. The most familiar example of a warp pile fabric in which the loops are left uncut is Terry cloth, or Turkish toweling. Somewhat similar to pile fabrics are what are known as napped goods, such as flan-



OPENING THE BALES OF RAW COTTON DELIVERED AT THE MILL AND FEEDING
IT TO THE FIRST MACHINES IN THE YARN MAKING PROCESS



IN THE CARDING ROOM

nelette, although they are produced in a different way. They are made in a plain weave with a filling of soft yarn. After being woven they are passed through a machine which teases or combs up the filling yarn, giving the cloth a fluffy napped appearance.

The double cloth weave is also really a variation of the plain weave. It is done by weaving two cloths on the loom at the same time and combining them into one by interlacing some of the warp and filling threads of one into the other during the process of weaving. The double-cloth weave is used for a variety of purposes. It is used to produce a double-face cloth, or a cloth with different patterns on each side, or a heavy cloth with a cheaper material on the back than on the face. It is also used a good deal in making velvets and the shorter-pile plushes—the pile being formed by the interlacing of threads between the two cloths. In this case the cloths are cut apart by a knife after being woven. The double-cloth weave is not much used in cotton goods, except for making tubular cloths, such as pillow cases. These, of course, are not connected throughout the piece in the manner of the regular double cloths.

The gauze or leno weave, however, is used to a considerable extent in the making of cotton goods, especially fancies. In this weave the warp threads are not laid parallel to one another but are made to cross one another in various ways. There are two sets of warp threads: the ground warp, in which the threads are laid parallel to one another, and another set of warp threads, known as the douping, which are intertwined among the regular warp threads as the weaving proceeds. This produces a loose, open fabric, like lace or netting. A typical example is a marquisette. The leno weave is used a good deal for making open-work patterns on plain goods. Fabrics made partly with a plain weave and partly with a leno weave are usually referred to in the trade as lace cloths.

The lappet weave is not so much a weave as a device for working simple embroidered figures into plain or gauze weaves. It is really an imitation embroidery. By means of needles placed in a sliding frame the figures are stitched into the warp during the process of weaving. It is an easy and economical way of producing small, simple raised patterns, such as dots and squares and broken stripes. A typical example of a lappet weave is a dotted swiss.

Variations in the weave are one of the most important ways of achieving designs in fabrics. The possible number of such variations is almost infinite. In addition, designs are achieved in equal variety by different methods of dyeing, printing and finishing.

CHAPTER VIII

FINISHING PROCESSES

WITH the exception of coarse brown sheetings, which are sold to consumers in an unfinished state, gray goods have to go through various finishing processes before they are ready for consumption. There are, however, certain classes of goods which come from the loom almost finished, and do not have to go through the intermediate stage of gray goods. These cloths are made from yarns which have been subjected to certain finishing processes before being woven. The largest use of finished yarns is for lace and hosiery; but they are also used in many woven fabrics, such as voiles, crêpes and silk mixtures, in all yarn-dyed fancies, and in all yarn-dyed staples, like gingham.

One important reason for dyeing fabrics in the yarn rather than in the piece is that dyed yarns permit the weaving of colored patterns, such as checks, plaids, stripes and figures, which are faster when woven than when printed. Another reason is that the cotton fiber has little affinity for dyestuffs, and it is impregnated more readily in the yarn than in the piece; so that, as a general rule, yarn dyeing is preferable for fabrics which are subjected to much sunlight or washing.

Strictly speaking, the term "finishing" includes only certain final treatments which are given to cloth before it is ready for the market. These treatments are somewhat similar in nature to those given by a laundryman to clothes after they have been washed, in order to produce a finish that is soft or stiff, dull or glossy. The number of different finishes applied to cotton goods is almost beyond count; but they may be loosely classified under the heads of stretching, sizing and calendering. Each of these processes is done in a variety of ways, according to the kind of finish that is desired.

While in the strict sense the term finishing includes only such processes, it is generally used for convenience to include also the processes of bleaching, dyeing, gassing or singeing, and mercerizing, which are applied both to yarns and to fabrics in the piece.

Gassing consists in singeing off the fuzz on the yarn so as to make it smooth and bright. It is done by passing the yarn or fabric through the blue part of the flame from a Bunsen gas burner. Sometimes it is done electrically, using a charged plate instead of

the gas flame. Fabrics which are not woven from gassed yarns are usually gassed before bleaching when a smooth, lustrous finish is desired. The best results are obtained when the gassing is done to the yarn. Gassed yarns are used for the most part in lace and hosiery, but there is also a considerable use of them in woven fabrics, such as voiles, silk mixtures and mercerized cloths.

Mercerizing has come to be one of the most important of all finishing processes. It takes its name from John Mercer, an English calico printer, who patented the process in 1850. Mercer's process was designed simply to give strength to cotton fabrics. In 1890, however, some German textile makers tried stretching the cloth in order to overcome the shrinkage caused by the mercerizing process and discovered accidentally that stretching gave the cloth a beautiful lustrous finish. Since then the use of mercerization has grown rapidly, and various improvements have been made in the process, until to-day some of the finest mercerized cottons can be distinguished from silk only by the eye of an expert.

Mercerization is done by soaking the yarns or cloth in a caustic alkali solution; usually caustic soda and sometimes caustic potash or sodium peroxide. The action of the alkali on the cotton fiber is three-fold: (1) It causes the fiber to shrink in length; (2) it causes the fiber to swell up like a tire tube when air is pumped into it, thereby making the fiber round instead of flat; (3) it brings about a chemical change in the cellulose which gives the fiber a greater affinity for dyestuffs. As a result of these effects mercerized cotton is stronger and more easily dyed than unmercerized cotton. The lustrous finish is obtained by stretching. The greater the stretch the greater the lustre, as a general thing. But as stretching beyond a certain point weakens the fiber, the finest mercerized yarns are made from Sea Island and long-staple Egyptian cottons, which have a high natural luster and can be subjected to a good deal of stretching without being weakened.

The best results are obtained when the mercerization is done to the yarn. But fabrics are frequently mercerized in the piece, especially when it is desired to produce certain special effects. For instance, silk stripes or other similar effects can be produced by covering the fabrics with a paste, except for those parts on which the mercerized design is to be produced, and then immersing the fabric in the caustic bath, which acts, of course, only on the exposed parts. Part mercerization of a cotton fabric also permits of interesting color effects when the fabric is dyed, because the mercerized part

takes the dyes more deeply than the unmercerized part.

Both yarns and gray goods must be bleached before being mercerized, dyed, printed or otherwise finished. The extent of the bleaching depends upon whether the fabrics are to be used as white goods or are to be dyed or printed. For white goods a very thorough bleaching is necessary. For dyed or printed goods the amount of bleaching required depends upon the depth of the color that is to be used. When goods are to be dyed black, for instance, scarcely any bleaching is required, whereas a thorough bleaching is necessary for goods that are to be dyed or printed in light colors. For convenience, we will take up the gray goods after they leave the loom and follow them through the full bleaching process.

The first operation is to wet the cloth and lay it away for a while in order to soften the sizing in the warp. Subsequently it is soaked in a weak solution of caustic soda or milk of lime, in order to remove all fats from it; after which it is thoroughly washed in pure water. In order to counteract the effects of any alkali that may remain from the soda or lime it is then treated to what is known as the brown sour or gray sour, which is a bath of water containing sulphuric or hydrochloric acid, or both. It is then washed again in pure water.

If a full bleach is required the cloth is next boiled for three hours in hot lye and resin soap, which takes out any fats or acids that may remain in the fiber. After another washing in pure water it is ready for the real bleaching operation. This consists of soaking the cloth for an hour or two in a bath of chloride of lime solution, and then exposing it to the air. It is the action of the oxygen in the air and water, set free by the chloride of lime, that bleaches the cloth. Subsequently the cloth is washed again and treated to a weak acid bath, known as the white sour, in order to stop further action of the chloride. Then it is washed in pure water, spread out, beaten, stretched, and dried over hot rollers. It is now ready for finishing, if it is to be white goods, and for dyeing and printing if it is to be colored goods.

There are, of course, a great variety of dyeing processes, depending upon the nature of the cloth, the purposes for which it is going to be used and the effects which the dyer wants to obtain. In general, whether the cloth is to be printed or dyed, it is first treated to what is known as a mordant, a substance which has a strong affinity both for the cotton fiber and the coloring matter, and which helps to unite them. Sometimes, as in extract printing, the mor-

dant and coloring matter are applied together. The mordant is fixed in the cloth by ageing it for a couple of days in a moist chamber and then treating it to a mixture of cow dung and chalk, or some substitute for cow dung. Then it is dyed by being passed over rollers and through the dye liquor until the desired results have been obtained. Subsequently it is washed very thoroughly and then dried, after which it is ready for finishing.

When the cloth is printed instead of dyed it is passed between copper rollers which have been engraved with the design and then covered with the color in the form of a paste. Where more than one color is used there is a different roller for each color. There are many styles of printing, the most familiar of which are the extract or discharge method and the resist or reserve method. In the extract or discharge method the cloth is first dyed and then printed with designs in chemicals which cause the dye to fade out partly or altogether where the design is applied. In this way colored cloths can be printed with white or different color designs. By the resist method the cloth is first printed with a substance which will resist the action of the dyestuff, and is then dyed—the dye leaving the printed design unaffected. Whatever method of printing is used, the cloth after being printed is very carefully dried. It is then steamed, washed, run through soapsuds, washed again and dried again; after which it is ready to be finished.

The finishing processes, as already mentioned, are in a general way similar to those applied by a laundryman to clothes after they have been washed. First the cloth is well stretched. Then it is treated to some kind of sizing or starching, according to the sort of finish that is desired. There are a multitude of sizing materials used, including wax, various fats and various starches. If a stiff or glossy finish is desired the cloth is calendered by heavy rollers. Many special finishes can be achieved by calendering. For example, the cloth may be stamped with various designs engraved on the calender rollers.

A well-known finish achieved in this way is what is known as the schreiner finish. In schreiner the rollers are engraved with a multitude of very fine lines. These break up the flat surface of the cloth into a multitude of different planes, and the resulting light refractions produce the effect of a very high luster. Mercerized cottons with a schreiner finish are as lustrous as satin. Other finishes beyond number can be and are obtained by slight variations in the manner of sizing and calendering.

CHAPTER IX

FROM MILL TO RETAIL STORE

IN criticizing the prices of cotton goods—and the prices of cotton goods are almost continually under criticism—it is a very common habit to figure raw material and production costs and ignore altogether the cost of distribution. Nothing could be more misleading, for the cost of distribution forms a very substantial share of the price at which cotton goods are sold. It is impossible to say, even in the most loosely approximate way, how large this share is, because it varies according to the nature of the goods, according to the location or other special circumstances of the mills and distributors, and according to the method in which the goods are distributed. Generally, it may be said that methods of distribution in the cotton goods industry are complicated and expensive. Probably they are too complicated and expensive. But, in any case, it is necessary to know what they are in order to arrive at a real understanding of the market.

We have already mentioned the fact that comparatively few concerns conduct all the processes in the manufacture of cotton goods from spinning to finishing. Many mills merely spin yarns for sale to weavers. Many simply weave cloths for sale in the gray to converters. Others make gray goods and have the various finishing processes done on contract for them by outside plants. Still others—many of them very large plants—devote themselves exclusively to the processes of dyeing, printing, bleaching or finishing. So that there is often a considerable distributing cost involved in the manufacture of cotton goods, even before the goods are put upon the market in a finished state.

In times of shortage and rising prices this cost is apt to be enhanced by speculative inter-sales of yarns and gray goods between brokers and converters. Fortunately the cost of distributing cotton goods in various stages of manufacture is kept down by the competition of the big mills, which conduct all the manufacturing processes themselves. These mills practically set the market, at least on staples. In other words, since the most powerful corporations are the ones which produce most economically, the prices of cotton goods under normal conditions are kept down pretty close to the basis of the lowest production cost by the pressure of competition.

The finished product of the mills is marketed in a number of different ways. Some mills sell their product direct to jobbers, retailers and cutters. But the great majority of mills market their product through selling agents, who are usually commission merchants, often referred to as factors. The commission house system, as it is practised in the cotton goods industry, is peculiarly American, and has grown out of certain limitations in our banking methods which have made it difficult for mills to secure adequate direct banking accommodation. Obviously the financial needs of a cotton goods manufacturer are very great, particularly at certain seasons of the year. He needs a large amount of capital, not only for operating expenses, but for the purchase of raw material and for carrying the accounts of buyers until the bills are paid. These requirements, as a general rule, are supplied by the commission merchant; so that the commission merchant is primarily the banker of the cotton goods industry.

Usually the commission merchant assumes complete or partial selling control of the product of the mill or mills to which he supplies financial accommodation. He may be the exclusive selling agent for the entire product of one big mill, or for the entire product of several mills, or for certain lines of different mills. Sometimes a selling agent is not a commission merchant and does not furnish financial accommodation to the mills he represents; and sometimes the commission merchant does not act as a selling agent, but simply finances manufacturers, selling agents and converters. As a general rule, however, the functions of commission merchant and selling agent are combined in the one concern. The manner in which the selling agent operates is about as follows:

Goods are consigned to him by the mill he represents, and in return he advances to the mill a specified percentage of the value of the goods—generally about 75 per cent of their selling price. He charges interest on these loans at the rate of 6 per cent. Some of his profit is made out of the difference between this rate and the market rate for commercial loans. If the market rate is higher than 6 per cent he is, of course, out of pocket on the transaction. The selling agent provides facilities for receiving, warehousing, displaying, selling and shipping the goods, as well as for financing and collecting buyers' accounts. When the goods are sold he credits the mill with the net value of the sale, less 6 per cent interest for the time remaining until the bills are collected. He also takes responsibility for the credit of the buyer.

In addition to interest charge on loans to the mill—which may or may not yield him a profit—the selling agent charges for his services a commission on the net sales. The size of the commission varies according to the nature of the goods. Staples, which sell in very large quantities, are handled on a relatively low commission, while fancies, which have a more restricted sale, are handled at a higher rate. Generally, the selling agent's commission ranges from 4 to 8 per cent.

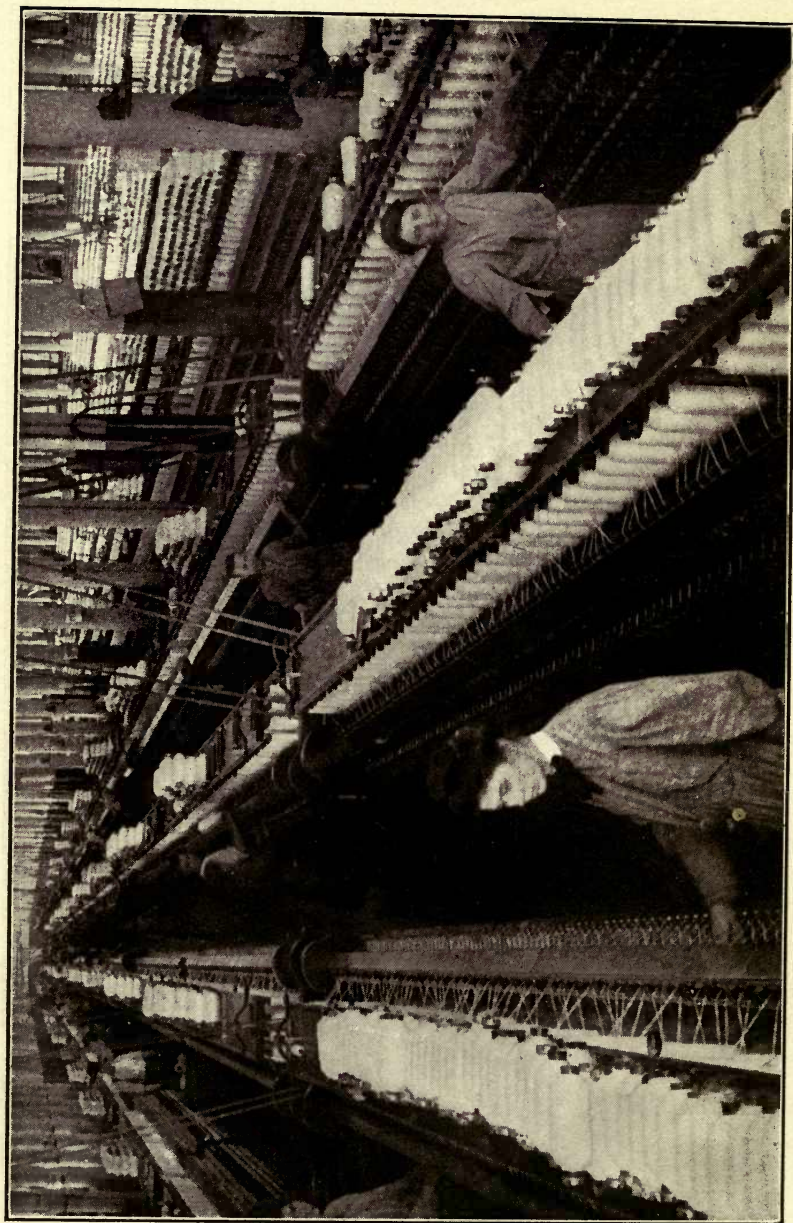
The selling agent, of course, is very close to the mill he represents, and, while it would not, perhaps, be correct to say that he dictates the market policies of the mill, he has at least a very powerful influence upon them. He advises the mill concerning styles and prices, and his intimate touch with market conditions, combined with his control over the finances of the mill, usually makes his advice decisive. Most of the big selling agencies are located in New York, although many mills are also represented by important selling agencies in Boston, Philadelphia, Baltimore and other cities.

Important as is the function of the selling agent, it may be said that, on the whole, the most important primary distributor in the cotton goods market is the converter. He gets his name from the fact that he buys goods in the gray and has them converted into finished goods according to his own ideas. He is really a cotton goods merchant who is also, in a certain sense, a manufacturer, although he does no actual manufacturing himself. But the function of the converter is a highly important one, inasmuch as he is a sort of specialist who originates new ideas and designs in cotton goods and takes the risk of trying them out on the market. He is a judge of cloth constructions and finishing processes, and his constant object is to create fabrics of superior attractiveness and serviceability to those offered by his competitors.

Since he is, more than any other distributor, in intimate touch with the sources of production, and since, unlike the selling agent, he is not tied up to any particular mill or mills, he probably exercises a greater influence than any other factor on the trend of the market. On the merchandising side, the converter is really a jobber, and very often a converting house will do a jobbing business in other lines besides those which it converts. Many of the big jobbing houses have their own converting departments and produce goods for sale under their own trade-marks. Sometimes the selling agent will act as converter for the goods of the mills he represents, but this is not customary.



DRAWING FRAMES AT WORK



WHERE YARNS ARE SPUN

As a general rule, the first step taken by the converter in preparing for a new season is to decide on the styles which he considers are likely to be good. Some of these styles, of course, are more or less staple. Others are novelties chosen from designs furnished by professional designers. Having decided on the styles he will put out, the converter orders his gray goods, either from samples submitted by the mill or according to samples or specifications submitted by himself to the mill.

In the case of staple constructions he will often buy spot goods through brokers in the open market. Most of his requirements, however, are covered by contract with the mills for delivery in instalments over a period running anywhere from three to six months. Usually the mills require a minimum order of about 30,000 yards, including short lengths and seconds, which must not exceed 10 per cent of the entire order. Payment is made for each instalment within ten days after delivery, a reduction of 5 per cent from the contract price being made for seconds.

Generally these goods are stored at the converter's risk and subject to the converter's order, either at the mill warehouse or at the warehouses of the finishing plants with which he has made arrangements to dye, print, bleach and otherwise finish the goods. Often the converter has connections of long standing with certain finishing plants to which he gives his business season after season; but usually at the beginning of each season he calls for bids from the various finishing plants equipped to do the kind and quality of work he wants, and makes his contracts for the season with those offering the best terms. The contract may call for deliveries in any quantity, but it is customary for finishing plants to require a minimum order of 2000 to 3000 yards for bleached or dyed goods and 7500 yards for printed goods. Deliveries are made in from two to ten weeks, depending upon the rush of business at the finishing plant. Normally, deliveries can be made within six weeks, but at times the finishing plants are so congested with work that converters may have to wait three months or more for delivery. Payment is made within thirty days after delivery.

From this brief résumé of the functions of the converter it is easy to see what a large share of the risk in distributing cotton goods is carried by him. He must take the risk of initiating new styles, and some of these are bound to fall flat and prove a dead loss. He must also, as we have previously remarked, act to some extent as the banker for the mill, the finishing plant and his customers.

Unlike the commission merchant, he does not directly finance the mills. But he pays for his gray goods within ten days after delivery and for his finishing operations within thirty days after delivery, while he may not collect from his customers until as long as ninety days or more after he makes delivery to them, so that his capital helps more or less to carry a number of different agencies all the time. Necessarily he is a large borrower in the money market, obtaining his accommodation from banks or commission merchants, or both. And this, in times of financial instability, adds greatly to the risks of his business.

Whether cotton goods are put upon the market directly by the mill or through the mill agent or converter, they pass to the retailer and thence to the consumer through two main channels: the cutter-up and the jobber. Cutters-up of shirts, waists, underwear, wash dresses, overalls, etc., are large consumers of cotton goods, and as a rule they buy direct from the mill agent. But many small cutters, and occasionally some large ones, buy also from the jobber. Practically all retailers buy their cotton goods from the jobber, although some of the big department stores deal directly with the mill agents. So that it is scarcely an exaggeration to call the jobber the greatest of all agencies in the distribution of cotton goods. He performs a function which, in a country as large as the United States, is practically indispensable, and the value of his services, both to the producer and the retailer, is not generally appreciated by either.

It would not be practicable for a mill or selling agent to keep in close touch with the tens of thousands of retailers in the country, to estimate their requirements, to be informed of their credit standing, to give them prompt and frequent deliveries of limited quantities. Neither would it be practicable for most of these retailers—many of whom are located hundreds or thousands of miles away from the centers of production—to keep in close touch with all the producers, know what the market has to offer and maintain without loss the considerable assortments which even a very small retailer must have to do business.

The jobber, however, furnishes the solution to these and many other distributing problems. He covers, as a rule, a limited territory which he knows intimately. He is informed on conditions there; he is familiar with the circumstances and requirements of his customers; he is in a position to give these customers more thorough and accommodating service than the manufacturer could possibly furnish. One of his most valuable services to the retailer, especially

the small retailer, is the maintenance of large and varied stocks out of which the retailer can fill in at short notice. He serves the manufacturer by placing advance orders in substantial volume, thus assuring a more or less steady volume of production, and by relieving the manufacturer of trouble and worry over a multitude of small accounts. As the orders placed by the jobber are large in volume and are an anticipation of probable demand from his territory, and as he usually carries the retailer's accounts for a considerable time after he has paid his own bills, it is clear that he bears, with the converter, the major share of the risk of distribution.

Jobbing houses are located in practically every important city in the country. Among the chief jobbing centers are New York, Chicago, St. Louis, Philadelphia, Baltimore, Pittsburgh, Boston, St. Paul, Minneapolis, Kansas City, St. Joseph, Omaha, Denver, Cincinnati, Columbus, Cleveland, Milwaukee, Atlanta, Savannah, Richmond, Memphis, Louisville, Dallas, Little Rock, New Orleans, Galveston, Salt Lake City, San Francisco, Spokane, Portland (Ore.), and Los Angeles. Many of the large jobbers sell to smaller jobbers as well as to retailers, and many large retailers also do a jobbing business. Normally about 70 per cent of the jobbers' sales are made through road salesmen, the remainder being made by mail or directly to retail buyers who visit the jobbers' warerooms.

In normal times the jobber begins placing his orders in May for the spring of the following year. He receives deliveries beginning in November and extending through the winter and early spring. Sales to the retailer are made for the most part in September and October, and deliveries begin in January. Orders for fall goods are placed normally by the jobber from October to December for delivery in June, and sold to the retailer from March to May for delivery in August and September. During the last few years the uncertainty of conditions has tended to discourage buying for distant delivery, and very little spring buying has been done by jobbers before September. Both jobbers and retailers at the present time show a tendency to reduce as much as possible the period between purchase and delivery, and this tendency will probably continue until conditions become more stable.

CHAPTER X

DICTIONARY OF COTTON GOODS

FOR convenience in merchandising, cotton goods are divided into a number of different classifications, the most important of which are Domestics, Prints, Wash Goods, White Goods, and Blankets and Flannels. These classifications, however, are used rather loosely. Different jobbers and retailers make different classifications, according to the arrangement of their departments. Retail stores, especially, are apt to classify cotton goods in a variety of ways. Some will classify domestics, blankets and flannels together under the heading of Domestics, some will classify wash goods and white goods together under the heading of Wash Goods, and some will simply have a cotton goods department which includes them all.

These are only a few of the large variety of classifications that different retailers adopt. Then again, a given cotton fabric may be included in two or more classifications. For example, muslins are included in both Domestics and White Goods, gingham in both Prints and Wash Goods, voiles and organdies in both White Goods and Wash Goods.

In general, it may be said that Domestics include brown and bleached sheetings, sheets, pillow cases, tickings, twills and drills; Prints include the staple low-end printed cloths, percales, staple gingham, and usually the heavier colored cottons, such as chambrays, denims, cheviots and the like; Wash Goods include the finer-end dress cottons, such as fine gingham, printed voiles, colored organdies, crêpes, silk mixtures and other fancies; White Goods include fine bleached cottons, like longcloths, lawns, nainsooks, dimities, white voiles and organdies, dotted Swisses, mulls, India linens, cambrics, damasks, and so forth, as well as piqués, gabardines, poplins, Bedford cords and fancy white skirtings; Blankets and Flannels, as the name indicates, include cotton blankets and napped goods, such as domets and flannelettes. In addition there are a variety of drapery and upholstery fabrics which do not come under any of these classifications.

Both for convenience in reference and because of the difficulty of adopting a definite classification, the writer has deemed it expedient to arrange the following definitions and descriptions of cotton goods

in alphabetical order rather than to group them under different headings. It would, of course, be impracticable to include in this list all the cotton goods on the market. An almost unlimited variety of fabrics are sold under the trade marks of manufacturers, converters and jobbers, and these are added to every season by numbers of novelties. Many of these fabrics differ from one another only in name, or in slight details of quality, construction or finish. The following list, therefore, takes no account of trademarked fabrics, or novelties, and includes only the principal staple fabrics familiar to the American dry goods trade.*

Albatross Cloth A lightweight, plain-woven fabric made in imitation of the worsted fabric of the same name. It gets its name from the fact that its soft finish resembles the downy breast of the albatross. Albatross cloth is a medium-grade fabric made from American cotton of fair quality, about 1-1/16 inches in staple. The yarn count is about 28's warp and 36's filling, and the construction usually about 48x48. It is generally sheared, singed, bleached or dyed, and finished by a light pressing, without any sizing. It is used as dress goods.

Apron Checks A narrow gingham with small white and colored checks. See GINGHAM.

Batiste A cotton muslin with a stiff finish, said to be named after one Baptiste, who invented it in Cambrai, France, in the 13th century. It is practically the same fabric as cambric. It comes in various widths and in various qualities, ranging from comparatively coarse to very fine. The finest grades are made from Sea Island cotton, with a high count of yarn—for instance, 100's warp and 150's filling. A typical construction would be 100x98. The cheaper grades also use Sea Island or Egyptian cotton and are made with a high-count yarn, as high as 60's warp and 100's filling. A typical construction for a cheaper batiste would be 56x52. Batiste is woven in the gray with a plain weave, and is subsequently bleached, heavily sized and calendered. The better grades are used for dress goods and lingerie, while the cheaper grades are used chiefly for linings in shirt waists.

Bedford Cord A heavy fabric characterized by raised cords varying from 1/20 to 1/4 inch in width and running warp-wise of the cloth. It is somewhat similar in appearance to piqué. Usually it is made

*For much of the technical matter embodied in the ensuing descriptions the writer is indebted to "A Cotton Fabrics Glossary," published by Frank P. Bennett & Co., Inc., Boston, Mass.

with a plain weave, the cord effect being obtained by introducing coarse-count warp yarns at intervals among the regular warp yarns. It is made of good American or Egyptian cotton, 1-1/16 to 1 3/8 inches in staple, and with fairly high-count yarns for regular warp and filling, such as 40's warp and 60's filling. The yarn used for the cord would be 20's or lower. As the fabric is heavy it has a very close construction, varying from 96x88 to 220x156. It is generally woven in the gray. It is used for dresses, skirts and sports costumes.

Beige This term is used to describe a fabric made with a mixed or mottled effect. The best grades are made of wool and the cheaper grades of cotton. The mottled effect is obtained by dyeing the raw stock and mixing it with undyed stock for spinning; but in cotton beige this effect is usually obtained by printing on both sides of the cloth. It is a plain-woven cloth made from medium-grade American cotton. The yarn count runs about 28's warps and filling, and the construction about 60x48. It is finished by a light starching and pressing, and has a soft feel. It is used for dress goods.

Bengaline A heavy fabric similar to poplin, with cords running either warp-wise or weft-wise. It is made of silk, silk and cotton, or all cotton. There are many qualities of bengaline on the market, varying much in character. It is a plain-woven cloth, made with a much finer and higher-count yarn in the warp than in the filling, and containing about twice as many ends as picks to the square inch. It may contain either single-ply or 2-ply yarns, and may be either yarn-dyed or piece-dyed. A typical construction for a bengaline would be 104x54, and typical yarn counts would be 2-ply 60's warp and single-ply 35's filling. It is frequently given a mercerized finish. Bengaline is used for dress goods, shirtings, draperies and hangings.

Bengal Stripes A strong, durable fabric similar to a gingham, and differing from gingham chiefly in having colored warp yarns dyed with Bengal indigo—although aniline dyes are frequently used now. The cloth was originally made in Bengal. The term Bengal Stripes is sometimes used to describe blue and white stripe effects on ginghams or percales, similar to those of the original cloth. The genuine cloth is indigo-dyed in the warp, is made from medium grade American cotton, 7/8 to 1 inch in staple, and with a low-count yarn, such as 9's warp and 16's filling. A typical construction would be 64x48. It is used for dresses and aprons.

Bishop's Lawn A fine, light, plain-woven fabric, with a bluish, starched finish. It gets its name from the fact that it was originally

used in England for clergymen's surplices. Bishop's lawn is usually made from Sea Island cotton, as high as $1\frac{5}{8}$ to 2 inches in staple, with high-count yarns, such as 100's warp and 120's filling. A typical construction would be 104x112. It is thoroughly bleached, given a light sizing with a blue starch, and calendered. It is used for summer dresses and underskirts.

Book Muslin This name is generally given to a stiff, rather coarse muslin. It is a fabric of open texture, made with a plain or leno weave, from medium-grade cotton, about one inch in staple, and with about 24's yarn in warp and filling. An average construction would be 54x45. It is piece-dyed in solid colors, heavily sized, and frequently given a glazed finish by passing between heated rollers in the calendering. It is used chiefly for underlining and millinery.

Brilliant A lightweight fabric, with small geometrical figures on a plain ground. It is made from long-staple American cotton, with a fine warp yarn and a heavier slack-twist filling. The average yarn count is about 50's warp and 30's filling, and the average construction about 88x66. It is made with a Jacquard weave. Usually it is mercerized or printed. It may have either a soft or a stiff finish. It is used for dresses and shirtwaists.

Calico A lightweight, narrow, closely-woven, plain cloth, with figured designs printed on one side, usually in two colors. The name was originally applied to all sorts of cotton goods, and is derived from the city of Calicut or Calcutta, whence cotton goods were first imported into England. It is now applied in England to plain, bleached cloths, heavier than muslin. Printed calico is made from medium-grade American cotton, not more than $1\frac{1}{16}$ inches in staple, with about 30's single-ply yarn. The average construction is about 66x52. The colors on calico are not fast. It is used for inexpensive wrappers, shirtwaists, and the like.

Cambric This fabric is made of both linen and cotton; and, as already mentioned, cotton cambric is practically identical with batiste. It is a stiff, heavily-glazed fabric, with a smooth, lustrous surface. There are many different constructions and qualities of cambric, but usually it is equivalent to the cheapest grades of batiste. The average cambric will contain good American cotton, running from $\frac{7}{8}$ to $1\frac{1}{4}$ inches in staple, and will be made with yarns counting about 28's or 30's. It is bleached or dyed and is used chiefly for linings. It gets its name from the town of Cambrai, in France, where it was originally made.

✓ **Canton Flannel** A medium or heavyweight soft cotton flannel, with a twill effect on one side and a long nap on the other. It is made from low-grade American cotton, $\frac{3}{4}$ to 1 inch in staple, and with low-count yarns, running from 10's to 20's in the warp and 6's to 14's in the filling. The filling is slack-twisted to permit of napping. The average construction is about 60x44. It is piece-dyed in solid colors. Canton flannel is used chiefly for underwear, house dresses, overcoat pockets, etc.

✓ **Canvas** A heavy, coarse, plain-woven cloth. It is made from medium-grade American cotton, about 1 inch in staple, and with multiple-ply yarns, such as 6-ply warp and 9-ply filling. The yarn count is usually about 14's warp and filling. Canvas is often made with an open texture, in imitation of a leno weave, for use as a ground for embroidery. The heavier canvas is used for bagging, shoes, tents, boat-coverings, etc.

Chambray A medium-weight, plain-woven cloth, made with a colored warp and white filling. The color of the warp is usually blue. It is made of good-grade American cotton, 1 to 1-1/16 inch in staple, with yarns averaging about 30's warp and 36's filling. A typical construction is 72x56. Chambray is given a gingham finish, and is used for working shirts, children's rompers, jumper dresses, etc.

Chambray Gingham A fine gingham with a lustrous finish, usually made in plain colors. See GINGHAM.

✓ **Cheese Cloth** A thin, lightweight fabric with a plain, open weave. It varies much in quality; but generally it may be described as a cheap cloth made from medium-grade American cotton, 1 inch or less in staple, and with yarns running from 28's to 30's in the warp and 36's to 40's in the filling. It is usually of low construction, varying from 20x12 to 48x44. Much higher constructions, however, are sometimes seen in some grades of cheese cloth. It is given practically no finish. This fabric has numerous uses. It is used for wrapping cheese, butter, etc., as well as for underlining, curtains, flags, fancy dress costumes and decorations, and many other purposes.

Cheviot A strong, fairly heavy, ribbed fabric with striped patterns. It is usually woven with a plain weave, a double warp yarn being used to create the rib effect. Sometimes, however, it is woven with a twill weave. It is made from medium-grade American cotton, about 1 inch in staple, with coarse yarns counting from 16's to 22's warp and filling. The warp yarns are given a heavy size and are

died in fast colors, generally blue or brown. The filling is white. Cheviot constructions vary considerably according to the quality and the weave. Typical constructions would be 40x36 and 62x52. The cloth is given no finishing, but is simply sprinkled and pressed after coming from the loom. It is used for workmen's shirts.

Chintz A fine, plain-woven fabric, printed with patterns in bright colors on a white or colored ground, and characterized by a glazed finish. It is made of good-grade American cotton, as high as 1 $\frac{3}{8}$ inches in staple, with high-count yarns, such as 80's, in the filling, and comparatively low-count yarns, such as 44's, in the warp. A typical construction would be 72x56. Chintz is bleached and printed, but never dyed, and is given a glazed finish by passing through heated calender rollers. It is used for drapery and upholstery.

Corduroy A pile fabric in which the pile forms marked warp-wise ribs. The rib pile is obtained by using one set of warp threads and two sets of soft-spun filling threads. A corduroy may contain anywhere from 160 to 500 picks of filling and from 36 to 48 ends to the square inch. It is made usually from good-grade cotton, about 1 inch in staple, and with yarns averaging from 28's to 30's in the warp and 20's to 24's in the filling. As a rule it is piece-dyed, but sometimes it is printed. It was formerly used exclusively for liveries, and working clothes, but it is now used extensively for sports clothes, negligées, dresses and upholstery.

Cottonade A coarse, heavy cloth, made usually with a strong single cotton warp and a cotton shoddy filling, spun on the woolen principle. The raw cotton used in it is of low grade and generally mixed with waste. It is dyed in the raw stock and given very little finishing. Cottonade is used mostly for cheap trousers.

Crash A plain or twilled fabric finished in imitation of linen. It is made from medium-grade cotton, between $\frac{7}{8}$ and 1-1/16 inches in staple, and with comparatively coarse yarns, running from 14's to 20's warp and filling. It may be made in a plain, twill or fancy weave from gray or bleached yarns. Sometimes it carries warp stripes of dyed yarn. It is finished by being heavily sized and calendered. Crash is used for toweling, summer clothes and carpet coverings.

Crêpe A fabric characterized by a crinkly surface. Crêpes are made in a great variety of weights, qualities and designs. All of them have the peculiar crinkly appearance, which is produced, as a general rule, by using yarns with an extra twist which makes them crumple

up when they are unwound off the bobbins or spools. Crêpe yarns have twice to three times the amount of twist given to yarns for other fabrics. Sometimes the crêpe effect is produced by part mercerization in the piece, although such fabrics are strictly seersuckers (q.v.). In the more expensive crêpes the yarns used for filling are given both a regular and reverse twist. Usually crêpes are made from low-count yarns, to allow for the contraction; but the quality and count of the yarns vary greatly in different lines. An ordinary crêpe of fair quality would be made from about 36's warp and 20's filling. The construction of such a cloth would be about 58 x 40. Generally crêpes are woven in the gray, with a plain weave, and subsequently printed or dyed. Sometimes they are made in fancy weaves. Dyed yarns are often used. Many fancy crêpes have a silk warp and cotton filling. Crêpes are used for dresses, waists, shirts, kimonos, négligées, draperies and many other purposes.

Cretonne A soft fabric printed in bright patterns on a white or colored ground. It is similar to chintz, except that it is not usually so fine in quality and has a dull instead of a glazed finish. Ordinarily it is made from medium-grade American cotton 1 to 1½ in. in staple, and with yarns ranging from 20's to 40's in the warp and 7's to 20's in the filling. An average construction is about 52 x 40. It is usually made with a plain weave, but sometimes with a twill or satin weave. Like chintz, it is used for drapery and upholstery.

Crinkle Cloth See SEERSUCKER.

Damask A cotton or linen fabric decorated with large and elaborate ornamental patterns. It takes its name from the city of Damascus, which was once famous for its fine silk fabrics. Originally the name was applied only to silk fabrics. The finest grades of damask are made of linen and the lower grades of cotton. Cotton damasks are made from a good grade of cotton, 1-1/16 to 1¾ in. in staple, with medium and high-count yarns, and are woven with a satin or Jacquard weave. They are bleached, well starched and calendered. Damasks are used for table covers, napkins, towels, etc.

Denim A strong, heavy, washable fabric. It is made from medium or low-grade American cotton, 7/8 to 1-1/16 in. in staple, with single low-count yarns—for example, 9's warp and 16's filling—and is woven with a twill weave. Usually it is yarn-dyed blue or brown in the warp with a white filling, but sometimes it is piece-dyed. A familiar denim construction is 60 x 40. Denim is finished with a heavy size and calendering. Used for workmen's overalls and outing skirts.

Diaper Cloth A soft, light, absorbent fabric, made from a good grade of cotton with a medium-count yarn in the warp and a soft, coarse yarn in the filling. A typical example would contain 30's warp and 14's filling. It is woven in the gray with a plain or twill weave, bleached, and finished so as to make it absorbent and antiseptic. It is used for towels and children's garments.

Dimity A light, sheer, washable white or printed fabric with fine cords running warp-wise. Except for the cords it is similar to lawn, batiste or muslin. The cord effect is obtained either by using two or more warp threads together, or by using coarser warp threads at intervals with the regular warp threads. It is made from Allen, Peeler or Sea Island cotton, 1½ to 2 in. in staple, and with high-count single yarns, such as 80's warp and 100's filling. The construction runs from about 56 x 52 to 120 x 120. It is woven with a plain weave and is subsequently bleached, printed with figured stripes in the direction of the warp, or dyed in pastel shades. Sometimes it is bleached in the yarn. It is finished with a light starching and pressing. Dimity is used chiefly as a dress fabric.

Domest A light fabric similar to flannel, napped on both sides. It is made of medium American cotton about 1-1/16 in. in staple, with 20's to 26's warp and 14's to 16's filling. The filling yarn is slack-twisted to permit of napping. It is dyed in the yarn or the raw stock, and comes either in bright solid colors or with warp-wise stripes. It receives no finish except the nap. It is used for shirts, pajamas, etc.

Dotted Swiss A light, soft, sheer muslin, decorated with dotted patterns in heavy yarn. It is usually made with a lappet or swivel weave, the ground cloth being a plain weave of fairly open construction. It is woven from combed yarns, counting as high as 90's warp, spun from long-staple American cotton. Typical constructions are 80 x 64 and 74 x 60. It is bleached in the piece and usually finished white, although sometimes it is printed or dyed. It is used for summer dresses, waists and curtains.

Drill A strong, medium-weight twilled fabric. It is made from short staple, low-grade American cotton, with coarse yarns, counting from 10's to 20's. Considering the size of the yarns, it is of close construction, such as 66 x 48. It is dyed in the piece or woven with dyed warp and white filling, and finished by brushing, sizing and pressing. It is used chiefly for working trousers.

Duck A heavy, stiff fabric of close texture, made of medium or low-grade American cotton, about 1 in. in staple, with coarse, hard-twist,

two-ply yarns of low count. The average count of duck yarns is about 10's. Duck is generally finished white, but is sometimes made with colored stripes. It is used for awnings, tents and sails, and the lighter weights for summer clothes.

Eolienne A fine lustrous fabric with a corded effect running weft-wise. It is usually made with a raw silk warp and a cotton or worsted filling. The filling is made from good American cotton, about $1\frac{1}{4}$ in. in staple, with 2-ply yarns, counting from 40's to 60's. As the silk warp threads are comparatively fine, the fabric contains many more warp threads than filling threads, 124x56 being a typical construction. It is woven in the gray with a plain weave, and is subsequently boiled, bleached and dyed. Sometimes it is cross-dyed with different colors in the warp and filling. It receives no finish except pressing. Eolienne is used for dresses.

✓ **Eponge** A soft, spongy cloth, made with novelty yarns of very coarse sizes, and containing a very small number of ends and picks per inch. Sometimes it is made with plain warp and novelty yarn filling and sometimes with novelty yarn warp and plain filling. It is usually woven in the gray and subsequently bleached and dyed. Sometimes it is made from bleached or dyed yarns. Generally it is made with a plain weave, but fancy weaves are often used. Because of the coarse yarn sizes the construction is very low, such as 16x17. It receives no finishing. Eponge is used for dress material, trimming and drapery. Some varieties of eponge are known as ratiné (q.v.). See NOVELTY YARN FABRICS.

Etamine A thin, crisp, slightly lustrous fabric of open texture. It is made from good American cotton, about 1-1/16 in. in staple, with hard-twisted yarns of coarse sizes, such as 10's. The construction is low, a typical construction being about 26x28. It is plain woven, usually in the gray, and subsequently bleached and dyed. It is finished by being fairly well sized and then calendered. Etamine is used for summer dresses and drapery.

✓ **Flannelette** A narrow, lightweight, printed fabric, napped on both sides. It comes in a variety of qualities, and may be made from low-grade, medium or good American cotton, from $\frac{3}{4}$ to $1\frac{1}{8}$ in. in staple, with single yarns counting from 14's to 30's warp and filling. The filling is slack-twisted to permit of napping. Usually it is woven in the gray, and bleached and printed in the piece. Sometimes it is made with stripes woven from colored yarns dyed in the raw stock. It is plain woven, with a construction generally containing a relatively

large proportion of ends to the square inch, such as 88x64. It is used for wrappers, kimonos, nightdresses, etc.

Galatea A printed sateen. It is made from medium American cotton, about 1 in. in staple, with yarns averaging about 25's warp and filling. As it is a satin weave, the construction usually shows many more ends than picks to the square inch, or vice versa—such as 124x56 or 72x120. It is woven in the gray, printed in plain colors or with figured, dotted or striped designs, and given a light starch finish. It is used for children's dresses, outing suits, shirtwaists, etc.

Gauze A name for a variety of fabrics made with a leno weave, or with an imitation of this weave, known as an imitation gauze or mock leno. The nature of a gauze or leno weave has been explained in a previous chapter. The imitation gauze or mock leno weave is achieved by using sets of three or more warp threads and sets of three or more filling threads, with open spaces between each set. The sets of warp threads interlace with the sets of filling threads, producing the effect of a leno weave. Both the leno and the mock leno weaves are used to produce plain gauze fabrics, or to produce fancy effects in combination with a plain weave. An example of the latter is a lace cloth. Gauze fabrics are used for dresses, curtains, aprons, shirts, canvas cloths, hammocks, laundry bags, etc. See SCRIM.

Gingham A light, durable, staple, wash fabric, produced in solid colors or in checks, plaids or stripes. The common gingham is always made with a plain weave from dyed yarns and comes in many grades. Usually it is made from good American cotton, as high as 1-3/16 in. in staple, with yarns counting 26's to 40's warp and filling. The construction varies from about 50x44 to 76x60. After coming from the loom it is sprinkled, well sized with starch, dried, stretched and pressed between hot calender rollers. It is used for women's and children's dresses, aprons, etc. *Apron checks* is a name applied to a common gingham made in small white and colored checks. *Zephyr gingham* is a fine dress gingham made from good cotton, running 1¼ to 1½ in. in staple, with combed yarns counting 40's to 60's warp and filling. It is yarn dyed, plain woven, and finished like the common gingham. *Madras gingham* is a very fine shirting gingham made from good grade cotton, 1¼ to 1½ in. in staple, with yarns counting from 50's to 60's warp and filling. It is made either with a plain weave or in fancy effects obtained by combining a plain weave with a jacquard or leno weave. It is finished like other ginghams.

Hickory Stripes A strong, durable, lightweight fabric, similar to

ticking, but more open in texture and softer in finish. It is made from medium-grade American cotton, about 1 in. in staple, with coarse-count single yarns, about 14's to 16's warp and filling. It is woven in a twill weave with blue and white or brown and white warp stripes and white filling. The colored yarns are sometimes spun from dyed stock. It is finished by shearing, sizing and calendering. It is used for working shirts and trousers.

Huckaback or Huck A soft, absorbent cloth used for towels. It is made of good American cotton, about 1-1/16 in. in staple, with soft twisted yarns, counting about 14's warp and 10's filling. It is also made of linen and cotton or of all linen. The weave is plain, with long floats of yarn. A typical construction would be 50x44. Huckaback is either plain white or has striped borders made with alternate stripes of colored and white filling.

Indian Dimity A fine dimity usually made from Sea Island cotton, about 1½ in. in staple, with combed yarns counting about 80's warp and 100's filling. It is used for summer dresses. See DIMITY.

Indigo Print A staple printed cloth, distinguished from other standard prints by having a printed figure on an indigo blue ground. See PRINTS.

Italian Cloth A light, strong, lustrous sateen. It is made of good American cotton, 1 to 1½ in. in staple, with single yarns averaging about 40's in the warp and 45's in the filling. It is woven in the gray with a satin weave, and like all such cloths it is of close construction, containing many more ends than picks to the square inch, or vice versa. After coming from the loom it is bleached, dyed, given a light sizing and calendered with heated rollers. It is used chiefly for linings and undershirts.

Jean A tough, durable, twilled cloth, usually made with cotton warp and low grade wool or shoddy filling. The yarns used in the warp are spun with a hard twist from low-grade cotton, about 1 in. in staple, and are dyed a grayish black. The average yarn count is about 20's. The cloth is given what is known as a dry finish—that is, it is brushed, sheared and pressed, without any washing or sizing. It is used for working trousers.

Lawn A soft, sheer, lightweight fabric of cotton or linen. It is similar to batiste or cambric. There are numerous grades of lawn. All of them are made from high grade American cotton, such as Peeler or Sea Island, running from 1¼ to 1½ in. in staple. It is woven with a plain weave from gray or bleached yarns in a variety

of constructions, ranging from about 56x52 to as high as 120 x 120. The yarn counts range from 40's to 100's warp and filling. Lawn is usually finished white, but sometimes it is printed in bright colors or tinted in pastel shades. It is given a soft smooth finish by light starching and calendering. It is used for summer dresses, waists and lingerie. See BISHOP'S LAWN and VICTORIA LAWN.

✓ **Linon** A very fine, light, closely-woven, slightly lustrous fabric. It is usually known as India linon. It is made from Sea Island cotton, $1\frac{1}{2}$ to $1\frac{5}{8}$ in. in staple, with combed yarns of high count, such as 90's warp and 110's filling. It is woven in the gray with a plain weave and has a high construction. A typical construction is 108x110. After coming from the loom it is sheared, bleached, lightly starched and well calendered. As a rule it is finished white, but sometimes it is dyed. It is used for summer dresses and waists.

Long Cloth A fine, soft, closely woven white fabric. There are many qualities of long cloth. An average quality is made from good American cotton, about $1\frac{1}{4}$ in. in staple, with soft-twisted yarns counting about 50's warp and 60's filling. It is woven in the gray with a plain weave. The constructions are the same as for a lawn or dimity. After being woven it is boiled, bleached, given a light size and calendered with slightly heated rollers. It is used for lingerie and children's wear.

8 **Madras** A strong, lightweight, washable cloth, usually showing very narrow, woven, colored warp stripes on a white ground. It is named after the city of Madras, India, whence it originally came. Madras is made in a variety of grades from good American, Egyptian or Sea Island cotton, averaging about $1\frac{1}{8}$ in. in staple, with single yarns counting from 26's to 80's warp and filling. It is usually woven with a plain weave, but sometimes with a twill weave. It is used chiefly for shirts and summer dresses.

Madras Gingham See GINGHAM.

✓ **Marquissette** A lightweight cloth of very open texture, made of silk, silk and cotton, or all cotton. Cotton marquissette is made from high-grade American, Egyptian or Sea Island cotton, with combed 2-ply yarns counting 60's to 100's. It is woven in the gray with a gauze or leno weave, and is subsequently bleached and dyed or printed. It is a dress fabric.

Moiré A watered effect produced on fabrics in the finishing process. Usually it is obtained by folding or rolling the cloth while damp and

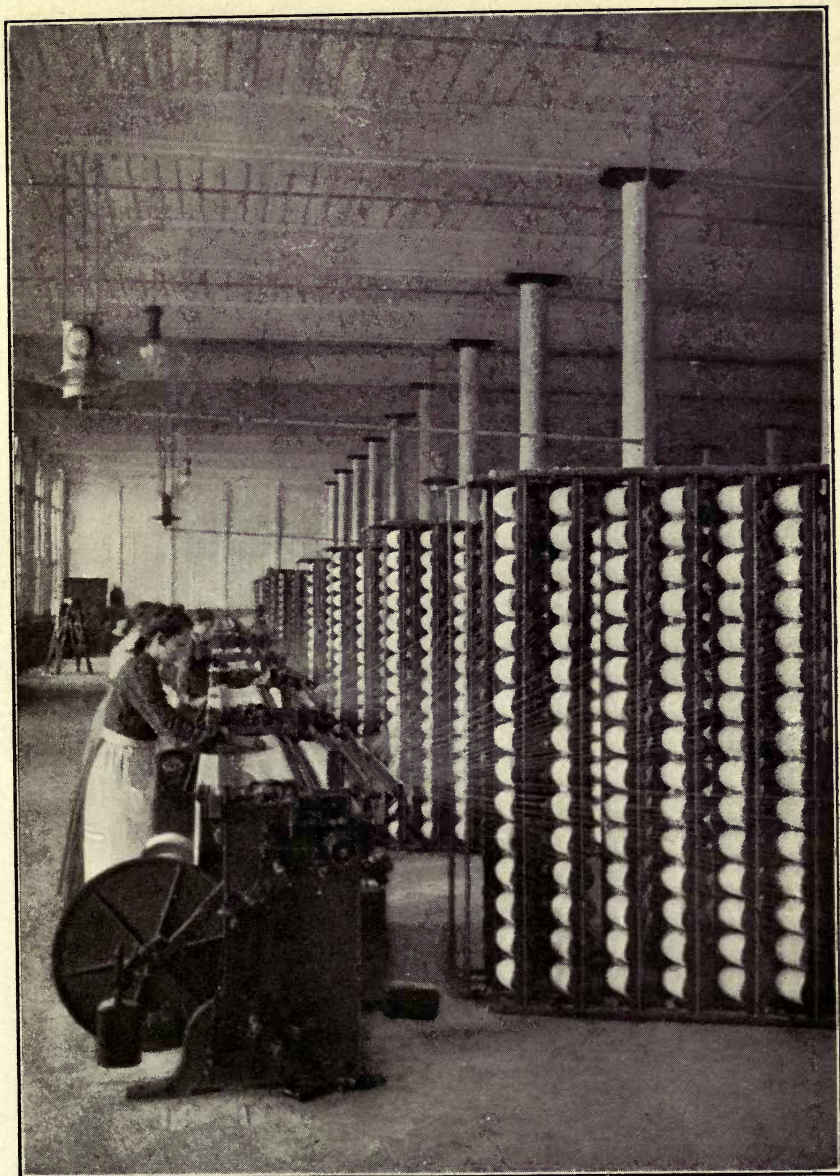
pressing it in the folded state between heated calender rollers. Sometimes engraved rollers are used. Moiré fabrics are used for linings, millinery, drapery, trimmings and other purposes.

Mull A light, sheer, very soft muslin. It takes its name from the Hindu word *mal*, meaning soft. In count and construction mull is the same as lawn (q.v.), the difference being in the finish. Mull is given a very soft finish by sizing with an oily solution. It is used for dresses. There is also a starched mull which is finished by sizing with a stiffening material, and is used chiefly for millinery and curtains. Starched mull is sometimes dyed.

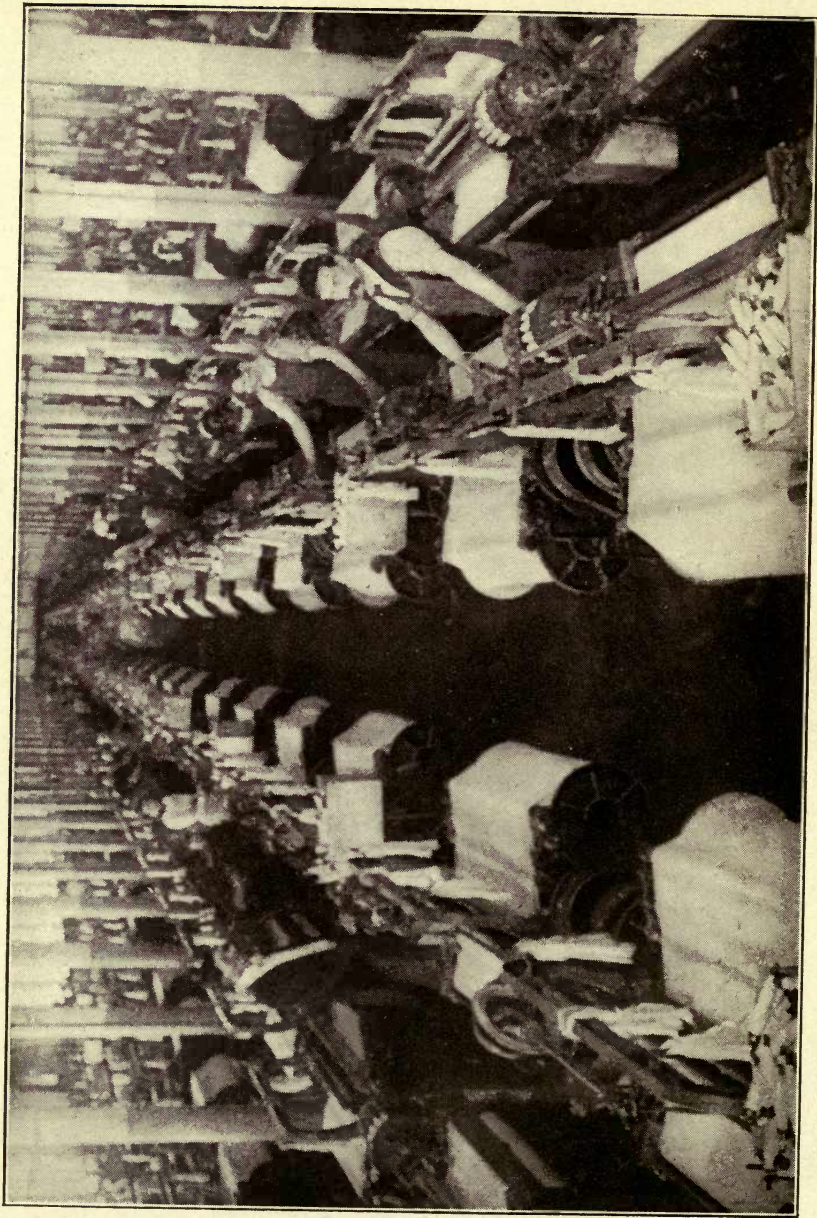
Muslin A name given to a great variety of soft, sheer, lightweight, plain-woven fabrics. The name is derived from Mosul, a city in Mesopotamia, once famous for the manufacture of fine cotton cloths. The finer grade of muslin are usually known by other names, such as batiste, lawn, linon, mull, nainsook, etc. Muslins may be made from cotton varying in quality from low-grade American to Sea Island, with yarns counting from 12's to 100's or higher. Muslin constructions run from 44x40 to 120x120. Sometimes it is made with woven warp stripes or embroidered effects. It is sold either bleached or unbleached. Bleached muslin is finished with a light sizing and calendering. It is used for dresses, aprons, shirts, sheetings, pillow cases, etc.

Nainsook A fine muslin, made either plain or with cord stripes or plaids. It was originally a strong Indian muslin, known as *nain-sukh*. In count and construction it is the same as lawn (q.v.), the difference being in the finishing process. It is produced with either an English or a French finish, the former being soft and the latter crisp. It is used for lingerie, infants' clothes, curtains, etc.

Novelty Yarn Fabrics A variety of fancy fabrics made altogether or in part with novelty yarns. Novelty yarns are produced by twisting a number of single yarns into one. Many different effects are obtained according to the kinds of yarns used and the manner in which they are twisted. For instance, a single colored yarn may be twisted with bleached yarns in such a manner as to produce colored loops or nubs, which appear as spots of color on the cloth. Sometimes tufts of bleached or dyed raw cotton are bound in with the yarns in the twisting. Novelty yarn fabrics are usually woven with a plain weave, or a plain weave in combination with other weaves. Many fancy crêpes, voiles, curtain fabrics, etc., are made with novelty yarn effects. Plain novelty yarn fabrics, because of the size of the yarn, are woven with a very low construction, such as 16x17, and receive



WINDING YARNS ON THE WARP BEAM



WEAVING COTTON CLOTH

no finishing. A typical example is an éponge (q.v.). They are used for dresses, millinery, drapery, etc.

Organdy A very fine, sheer muslin with a crisp, transparent finish. It comes in many different qualities, but usually it is made from Sea Island cotton with combed single yarns counting from 80's to 120's. It is woven in the gray with a high construction, such as 88x80 or 96x100, and is bleached, dyed in pastel shades or printed with small figures. It is finished by sizing with a substance such as albumen, casein or dextrine, after which it is well calendered. The finish on domestic organdies, as a rule, is not permanent. Organdy is used for dresses, sashes, neckwear, etc.

Osnaburg A coarse, strong, durable cloth, named from the city of Osnaburg, in Germany, where it was first made. It comes in solid colors, in checks, or in blue and white or brown and white warp stripes. It is made from low-grade American cotton, $\frac{7}{8}$ in. or less in staple, with single-ply yarns counting 14's to 20's warp and filling. It is woven with a plain weave from dyed yarns, and receives no finishing. An average construction would be about 52x46, which is close considering the coarseness of the yarns. It is used for working clothes.

Percalé A plain-woven, lightweight cloth of close texture, with a dull finish. It is of French origin and is sometimes known as French cambric. It is made from good American cotton, 1 to 1-1/16 in. in staple, with single yarns, counting about 30's on the average. The standard percalé construction is 64x60. It is woven in the gray and subsequently bleached and printed in fast colors on one side. Sometimes it is sold in the bleached state. It is finished with a light starching and tentering. Printed percalé is used chiefly for dresses and shirts, and bleached percalé for handkerchiefs and aprons.

Percaline A light fine fabric with a lustrous moiré finish. It is made from good American cotton, 1 to 1-1/16 in. in staple, with single yarns counting 30's to 40's warp and filling. It is plain woven in the gray with a pretty high construction, such as 84x84, and is subsequently bleached and dyed in solid colors, well sized and calendered by the moiré process. Percaline is used chiefly for linings.

Piqué A strong, heavy fabric woven in cross-ribbed or figured effects. Piqué is made with a double-cloth weave, and has two sets of warps, one of which binds the back and face together. The ribs are usually formed with filling yarns of coarser count than the regular filling yarns. It is made as a rule from good grade American cotton, about 1 $\frac{1}{8}$ in. in staple, with yarns averaging about 30's. It is gen-

erally finished white. It is used for skirts, men's dress waistcoats, neckties, shirtfronts, bedspreads, etc.

✓ **Poplin** A fabric characterized by fine weft-wise ribs. Originally it was made with a silk warp and a heavier woolen filling, which created the ribbed effect. In cotton poplins the same effect is created by using a coarser yarn in the filling than in the warp. It is made, as a rule, from good grade American or Sea Island cotton, $1\frac{1}{4}$ to $1\frac{1}{2}$ in. in staple, with 2-ply yarns counting from 40's to 60's warp and filling. It is woven in the gray with a plain weave. Subsequently it is bleached, and frequently mercerized, in the piece. Sometimes it is bleached or mercerized in the yarn. The construction shows a much higher count in the warp than in the filling, such as 104x48. It is a dress material.

✓ **Prints** A variety of staple plain-woven fabrics, printed with simple patterns on a white or light-colored ground. They are made from middling American cotton, about 1 in. in staple, with yarns averaging about 28's warp and 36's filling. Regular print cloth constructions run from 44x40 to 80x80, the standard constructions being 64x60 and 64x64. They are used mostly for house dresses, slips and the like.

Ratiné A name applied to a variety of fancy fabrics, some of which are identical with *éponge* (q.v.), and some of which are practically identical with terry cloth (q.v.). The name describes an effect rather than a fabric.

✓ **Sateen or Satine** A strong, lustrous fabric, usually piece-dyed, but sometimes printed. It is made usually from good American or Egyptian cotton, as high as $1\frac{1}{2}$ in. in staple, with yarns counting from 40's to 80's, although some coarse sateens are made with yarns counting as low as 14's. It is woven with a satin weave, either warp-faced or filling-faced. The best qualities are filling-faced. Typical constructions are 64x112 and 72x120. Sateens are woven in the gray, sized with starch or an oily solution, according to whether they have a stiff or a soft finish, and calendered. They are used chiefly for linings and corset covers, and the coarser grades for furniture and mattress coverings.

✓ **Scrim** A lightweight cloth of very open texture, resembling a net. It is made in a variety of qualities, from low-grade, medium or good American cotton, $\frac{3}{8}$ to $1\frac{1}{4}$ in. in staple, with 2-ply yarns counting about 10's to 40's. It is woven with a gauze or leno weave, usually in bright stripe and plaid effects, and receives no finish except hot

pressing. It is used chiefly for curtains and drapery, and the lower grades for hammocks and laundry bags. See GAUZE.

Seersucker or Crinkle Cloth A lightweight, plain-woven wash fabric characterized by crinkled warp stripes. It is made from good American cotton, about 1 in. in staple, with single yarns counting about 30's warp and filling. The crinkled stripe effect is produced by giving a slack tension to the warp threads forming the stripes, so that they become crinkled in the weaving. Sometimes this effect is produced by mercerization. Seersucker is woven from dyed yarns and given a gingham finish. Gingham with seersucker stripes are known as seersucker gingham. It is used for dresses, waists, rompers, etc.

Shade Cloth A plain-woven white or green cloth with a smooth, firm, lustrous finish. It is made in many qualities, but on the average it is made from good, medium-staple American cotton in the regular print cloth constructions. It is woven in the gray, piece-bleached and dyed, and finished by being well sized with a mixture of oil and starch, dried, dampened and calendered. It is used for window shades.

Sheeting A lightweight, plain-woven fabric, sold either bleached or unbleached. It is made from medium to good American cotton, with yarns counting about 18's to 40's warp and filling. It is woven in the gray and receives no finishing. Regular sheeting constructions run from 44x40 to 56x60. The standard construction is 48x48.

Silesia A strong lightweight fabric with a highly lustrous finish. It is made from good American cotton, about 1 1/8 in. in staple, with yarns counting about 30's to 40's warp and filling. It is woven in a twill weave with a high construction, such as 90x72, and is piece-dyed in dark colors and given a schreiner finish. Used for linings.

Terry Cloth or Turkish Towelling A soft fabric with small loops of uncut pile on one or both sides. It is made, as a rule, from a fairly good grade of American cotton, about 1 in. in staple, with 2-ply yarns counting 20's to 30's in the warp and single yarns counting 20's to 30's in the filling. It is woven with a variation of the twill weave, known as the terry motion (from the French *tirer*, meaning to draw or pull). Two sets of warp threads are used, one of which is very slack. As the filling threads are beaten up (pushed together) in the weaving they draw the slack warp threads into loops. Sometimes the same result is obtained by inserting wires weft-wise in the cloth, over which the warp yarns pass in the weaving, leaving loops when the wires are withdrawn. Terry cloth is usually woven in the gray

and subsequently bleached, dyed or printed. It is used chiefly for towels and bathrobes. Many dress fabrics made on the terry principle are sold under other names, such as *éponge* or *ratiné* (q.v.).

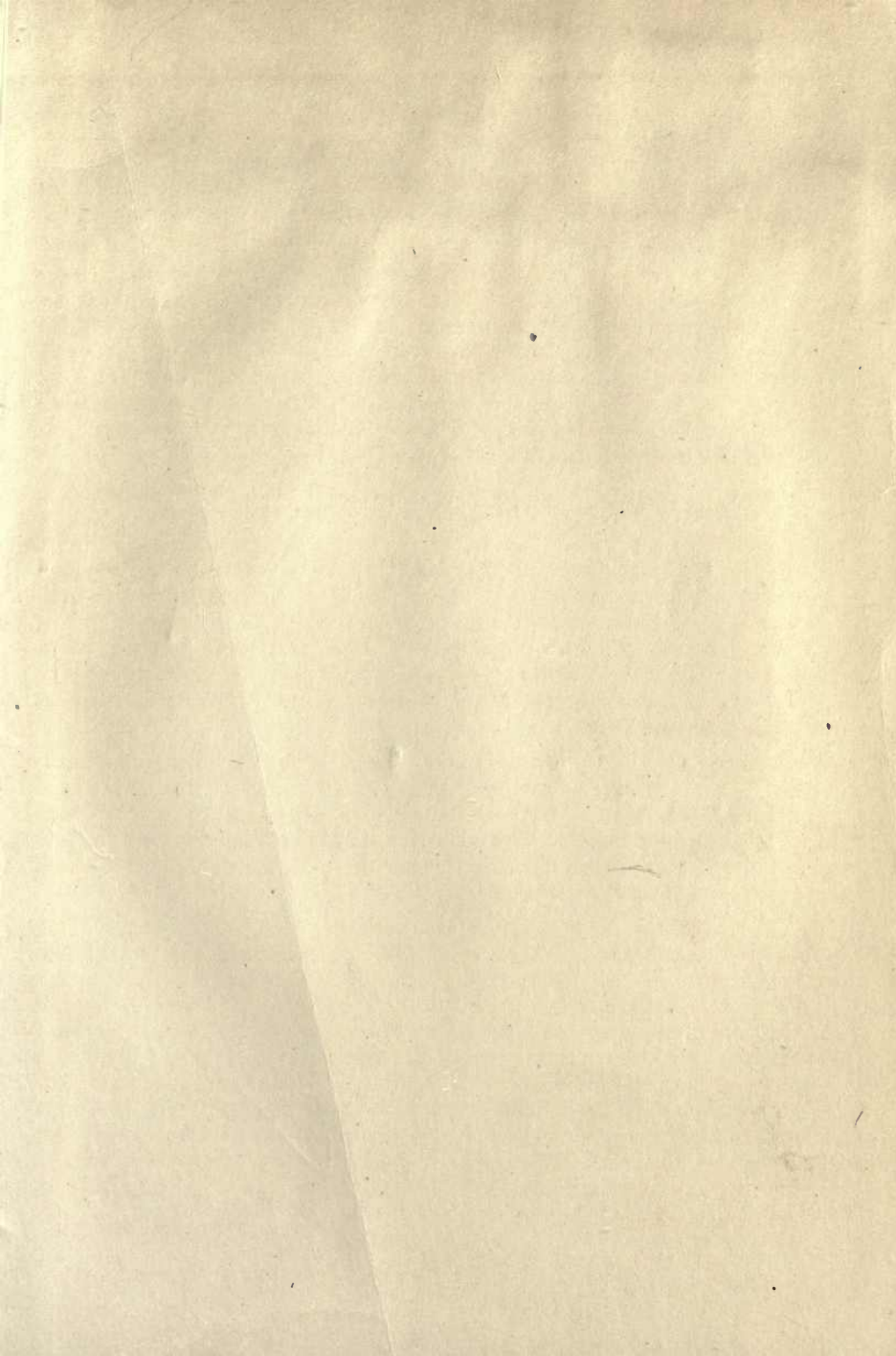
Ticking A strong, stiff, heavy, twilled fabric. It is made from fairly good American cotton, $\frac{7}{8}$ to $1\frac{1}{8}$ in. in staple, with single yarns counting about 14's to 22's warp and filling, the warp yarns being of coarser count than the filling. The weave is a warp-face twill. It is woven with yarn-dyed warp stripes and white filling. Frequently the colored yarns are spun from dyed raw stock. Ticking is finished by being brushed, sheared, sized and calendered. It is used for mattress, pillow and bolster coverings.

Velveteen A pile fabric with a very short pile. It is made from good American, Egyptian or Sea Island cotton, $1\frac{1}{8}$ to $1\frac{1}{2}$ in. in staple, with single or 2-ply yarns counting from 30's to 80's warp and filling. It is woven in either a plain or a twill weave, with extra filling threads which form floats on the surface of the cloth. These floats are subsequently cut with a knife, making the pile. The construction shows a very high count of picks to the square inch, running from about 50x156 to 76x600. Velveteen may be dyed either in the yarn or the piece, or printed or embossed. It is used chiefly for dresses, trimming and upholstery.

Victoria Lawn A heavy, closely woven English lawn, similar to *linon* (q.v.). It is made from high-grade American or Sea Island cotton, $1\frac{1}{2}$ to $1\frac{5}{8}$ in. in staple, with yarns counting about 80's warp and 110's filling, and a high construction, such as 120x120. It is finished white or printed, lightly starched and calendered. It is used for dresses, aprons and lingerie.

Voile A sheer, lightweight, plain-woven fabric. It is made from good American cotton, $1\frac{1}{8}$ in. to $1\frac{1}{4}$ in. or more in staple, with hard-spun single or 2-ply yarns, counting about 50's to 60's. Voile yarns are given a high twist and are frequently gassed. Domestic voiles are seldom made from yarns counting higher than 60's, but some imported voiles are made from 2-ply yarns counting as high as 140's. Domestic voile constructions rarely run higher than 64x64, the standard construction being 60x56. Voile may be dyed in the yarn or the piece, printed or mercerized. Fancy voiles are made in a variety of woven and printed patterns. The finish depends upon whether the cloth is yarn- or piece-dyed, printed, silk-striped, etc. Voile is a dress fabric.

Zephyr Gingham See GINGHAM.



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